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Electrical Exports.

A very interesting relative study of machinery exports from the United States and the United Kingdom is made in a recent Consular bulletin of the Department of Commerce and Labor. The figures are for 1904. It shows that our exports of electrical machinery were $7,409,200 and those of England only $2,545,200. As a matter of fact our exports to British possessions alone were $2,695,800. The United Kingdom sent us no apparatus, but we sent there electrical machinery worth $885,100. Japan, the great ally of England in the East, took $1,239,900 from us and only $286,200 from the United Kingdom. This is a striking testimony to the popularity of American electrical goods, for these conditions are severely reversed in many lines. In steam engines, for example, for stationary purposes, the British export was $6,022,900, while the American was only $2,116,100. The exports of locomotives from each country were around three and a half million dollars, but with the growing adoption of heavy electric traction these figures also may soon become more thoroughly Americanized. It will be understood that these statistics do not include electrical instruments, which might also show a big balance our way; but on the other hand England ships submarine telegraph apparatus all over the world, and that would be a heavy item in England's favor. There is also a large export of copper wire and cable, but England might offset this again with her large production of submarine ocean cable for the world at large. It would be very interesting to see how all these figures for both countries compare with those of Germany.

The Sageness of Sage.

The passing away of a man of 90 with 90 millions of dollars to his credit—or discredit—is sure to attract atention, and hence the death of Russell Sage comes in for a good deal of comment. Some of the things said about him are rather harsh, reflecting on his penurious habits and his abnormal development along the line of acquisition. The critics are not inclined to admit that standing in line with messenger boys to buy an apple for lunch illustrates liberality of spirit; or that picking up discarded newspapers in the train, to save a cent, enforces any particular truth in healthy economics. The promptitude with which he used another man's body to protect himself from a dynamite bomb and refused any compensation for injury, is not thought to exhibit the nobler aspect of altruism. But the *Wall Street Journal* says: "Whatever else may be said concerning Russell Sage, this, at least, can be said to his credit—namely, that he possessed many of the qualities which make a good director. In addition to his financial ability, which was of course very large, Mr. Sage brought to the directors' table a regular attendance, and, what was valued still more, the same careful scrutiny of policies and expenditures which he gave to his own personal business. A fellow director of his for many years says that no man made a better trustee of other people's money."

We are a little inclined to join issue here. It is no crime in our eyes that Sage was an intimate friend of Jay Gould, or was always eager for his director's fee, but we have ever held it against him that long after electric traction had demonstrated its ability to increase enormously the productiveness of a transportation

property, he opposed tooth and nail its use on the Manhattan system. He saw the road losing business and its traffic melting like ice in the sun, but still he wanted no such costly change as that, if only the old dividend could be squeezed out. Now a directorship held in that fashion is pernicious and unfaithful to the last degree, involving the destruction and not the preservation of the property trusteed. In like manner it has always been understood that the parsimony often seen in the old Western Union management, so hurtful to telegraphy, was due more to Sage than anybody else. The directors' board is better without such men, for they stand in the way of justice to employes and are enemies of public progress.

Photometry.

The article on photometry by Profs. Franklin and Esty, appearing elsewhere in this issue, emphasizes the importance of the mean spherical candle-power of a lamp, or its total flux of light, as distinguished from its horizontal candle-power, in some determined direction, or from its mean horizontal candle-power. In fact, the more one considers the hitherto usual practice of estimating lamps by their mean horizontal candle-powers, the more inadequate and imperfect the practice appears, although it has been largely a trade necessity, and to that extent has been unavoidable. One might just reasonably attempt to state the size of a ship by giving its horizontal length only, with no mention of its height or beam. As a general rule, of course, there is a rough agreement between the beam, height and length proportions of a ship; but there is no such necessary agreement, and a contract for the construction and delivery of a ship 400 ft. long might, in the absence of any other specification, lead to the production of a very remarkable looking craft. We are aware it is contended that at the present time it would be undesirable to change the commercial rating of an incandescent lamp from its mean horizontal to its mean spherical candle-power, unless gas jets became similarly changed in rating; that electric light is sold in competition with gas, and to sell an incandescent lamp on the basis of its mean spherical candle-power would be to throw away from 10 per cent to 20 per cent of its value in the eyes of the public, which would not appreciate that gas jets are already usually rated at their maximum horizontal candle-power and that electric lamps are already handicapped about 4 per cent by being rated at their mean horizontal candle-power. Nevertheless, the trade requirements are no excuse for neglecting the plain facts of the case, which necessitate the spherical candle-power being considered; so that an average spherical reduction factor should accompany each type of incandescent lamp.

Practical Inefficiency.

A paper by Mr. Vignoles, which we abstract this week in the Digest, gives the engineer food for reflection. It is a fact only too familiar that central stations in actual operation generally do not show an economy anywhere near to that indicated by tests upon the generating units. The situation is commonly passed over with somewhat contemptuous remarks about "test conditions." This is no explanation at all, since such conditions merely indicate that the plant is being for once operated with proper care. As regards coal consumption, a test may be deceptive by reason of using an exceptional grade of coal and firing with unusual care. But if as in most recent plants mechanical stokers are used, and the coal is of the regular grade, there is no reason why test results should not be closely approached all the time. If they are not there is something wrong which should be investigated. Of course, variation of load on an electric station may be a serious matter. In large plants the load factor can be kept high as regards the generating sets actually running, and the difference is discounted by the fact that the load curve of the generating set is a usual subject of test. The striking feature of the situation is the lack of economy often shown when taking into account the efficiency of the machinery at varying load.

Mr. Vignoles' report is from a station of moderate size, not particularly good load conditions, and only tolerable economy. Its particular value lies in the careful analysis of the steam losses, showing plainly the difference between engine economy and plant economy. The worst fault of most tests is the deliberate neglect of the losses in the various auxiliaries, including piping. It is quite time that these are separated from the losses of the generating sets, and Mr. Vignoles' data shows how far they go in affecting plant economy. He divides the total steam required into three parts—the standby steam, the engine load steam and the auxiliary load steam. The first includes losses by leaks, condensation, blowing off and auxiliaries at no load on the generators. In his case it amounted to something like 12 per cent of the total steam used at normal load. The auxiliary steam under load amounted to nearly as much more, so that nearly one-quarter of the total steam was used otherwise than for carrying load. The generating units themselves seem to have given a rather indifferent performance under the conditions of running, some 33 lb. of steam per kw-hour. If they had been doing well, say, 20 lb. or less per unit, the showing of waste would have been even more serious. The result shows the necessity of very carefully watching the incidental losses and of using efficient auxiliaries. Every item of the auxiliary account ought to be looked over with scrupulous caution and the leaks stopped. Even the power used to work the stokers is not negligible, representing in this case about 2½ per cent of the total. The cost of mechanical stoking in this plant, including interest charges, depreciation and repairs, amounted to but 15 cents per ton of coal fired and the evaporative result was about 6 lb. of water per pound of fine slack.

In the last resort the dynamical efficiency of a plant should be judged by the returns in kw-hours per dollar's worth of coal burned. Unless mechanical stokers are used one cannot be sure enough of the fireroom end of the proposition to make this criterion available, but one can at least take accurate account of the water evaporated, and thus keep the plant under continuous test. The losses in the auxiliaries are sometimes, although rarely, known, while the incidental standby losses examined by Mr. Vignoles generally are dropped out of sight. A preventable loss of 10 per cent or more is a rather serious matter and just as important from the standpoint of economy as a loss of 10 per cent in the generating sets, about which a howl would be raised the moment it was detected. A first-class modern generating set is capable of delivering the kw-hour on, say, 16 to 17 lb. of steam at full load, but the actual figure, including the auxiliaries, is very rarely as low as 20 and often 22 to 25 lb. Of this difference, variation in load accounts for a part, the remainder being due to incidentals and auxiliaries. Mr. Vignoles' standby consumption is a very convenient way of taking systematic account of miscellaneous losses, including everything that does not vary with the load. It would be well to further subdivide it, perhaps, so as to exclude the losses in the generating set when running without load. The auxiliaries are not easy to take exact account of, which is the reason they so often escape proper atten-

tion. They should, however, be investigated very carefully. An extra loss of even 5 per cent in efficiency at the generator would cause the immediate rejection of the machine and a vigorous row with the makers. Why should a station manager be any more patient with an equal loss elsewhere in the system when it is preventable without material increase of expense?

RECENT DEVELOPMENTS IN ELECTRIC LAMP FILAMENTS.

Our Austrian contemporary, *Elektrotechnik und Maschinebau,* has recently published an interesting paper by A. Libesny, read before the Elektrotechnischer Verein, of Vienna, on recent developments in lighting. The paper gave particular attention to Osmin lamps, the trade name of an Austrian incandescent lamp containing an osmium filament. It will be remembered that osmium filament lamps, the invention of Auer von Welsbach, have been experimented with for some years in Europe and especially in Austria. These lamps gave evidence of a very high, safe temperature and brilliancy, but the main difficulty with them was in regard to their low working resistivity, thus necessitating a relatively great length and small diameter of filament to produce a 100-volt lamp. Until recently 37-volt lamps were the highest obtainable in regard to terminal pressure, and it seemed as though filaments of osmium would have to be reserved for special applications in lighting where low voltages were employed.

According to the publication here considered, the osmium filament lamps have made progress in their voltage. Osmium lamps were exhibited of 40 hefners (36 cp) at 120 volts and of 80 hefners (72 cp) at 200 volts. The diameter of the osmium filaments was given as about 0.03 mm. or 30 microns (1 mil), or approximately half the diameter of a fine human hair. According to a report of tests made on Osmin 54-volt lamps at the Technologischer Gewerbemuseum at Vienna, the original specific consumption was 1.03 watt per hefner (1.21 watt per candle). After burning for 1,776 hours, 1.10 watt per hefner (1.22 watt per candle) was the average consumption during that time. The test was still being continued, as the lamps had not fallen below 80 per cent of their original candle-power. It is evident that if such lamps can be manufactured at a moderate price there is a large market for them. The tantalum lamp for direct current is a great improvement over the ordinary carbon lamp, and consumes, roughly, 2 watts per candle. If the osmium lamp can be developed industrially to the consumption of 1 watt per hefner, electric light could be produced about as cheaply as Welsbach light, in addition to its other advantages. Moreover, tests from the factory were quoted showing that osmium lamps had been produced which gave 119 hefners at 136 volts and 60 watts, or with a consumption of half a watt per hefner (.55 watt per candle). No data concerning the average useful life of such lamps were, however, offered.

Similar, but less authoritative, results were quoted for the "Sirius," another metallic filament lamp, and for the wolfram or tungsten lamp; that is to say, specific consumptions of 1 watt per hefner, or lower. The paper then takes up the theoretical treatment of the subject of radiation from luminous sources, discussing the influence of temperature and of material upon the illuminating power of the filament. There can be no doubt that a large share of the greater economy of tantalum, osmium and tungsten filament lamps is due to the higher temperatures at which they can be safely worked. It is well known that the hotter a glowing black substance becomes, the greater the proportion of its radiation that falls within the luminous spectrum, or the greater its luminous efficiency. But this is not all. Prof. Lombardi has found that the temperature of 1.5 watt per hefner osmium filaments to be about 135° C. lower than 3.5 watt per hefner carbon filaments. That is to say, the lower temperature osmium gave a much larger proportion of its radiation in the visible form than the higher temperature carbon. This means that a metallic filament, such as osmium, departs from the laws of radiation recognized for a black body, like carbon, and emits radiation selectively in a larger proportion as short waves. Such selective radiation is a very valuable property from an industrial standpoint, since lamps are nearly always worked as light-givers and not as heaters.

The early incandescent lamps of bamboo carbon gave about ⅕ of a hefner per watt under commercial conditions. The latter-day carbon filaments give approximately ⅓ of a hefner per watt, tantalum filaments about ½, and these osmium filaments about 1 hefner per watt, or even more. The question arises as to how high an efficiency can be reached theoretically. The best answer that can be made at the present time is that an ideal incandescent lamp, emitting an imitation of daylight in regard to color values, but emitting no invisible radiation, would give about 15 hefners per watt. If, however, the said ideal lamp gave out all its radiation in the green light to which the human eye is most sensitive, then perhaps we might get nearly 100 hefners per terminal watt, in this green light. Not only do Osmin filaments show a lower temperature than carbon for the same degree of brightness, but they also produce more luminosity per square millimeter of active surface, which is equivalent to the same thing. Thus osmium filaments produce from ⅓ to ¼ of a hefner per active mm.^{2} of filament surface against about 0.8 of a hefner per mm.^{2} in carbon when both filaments are worked at 1.5 watt per hefner.

EFFECT OF VARIATION OF FREQUENCY ON OUTPUT OF ALTERNATORS AND TRANSFORMERS.

There are at present many small electric lighting plants operating alternators which generate at a frequency of 125 to 133 cycles, which plants will probably eventually have to change over to the standard frequency of 60 cycles. The question often comes up whether it is feasible to lower the frequency by reducing the speed and changing the armature connections or winding. The change in speed is, of course, easily accomplished and in view of the high speed of the old high-frequency machines, a reduction of speed is desirable from a purely operating standpoint. As we frequently receive inquiries on this subject and on the effect of using a transformer at a frequency other than that for which it was designed, we give below a résumé of the electrical principles involved in both cases.

When it is desired to change the frequency of the current delivered by a certain alternator without the necessity of reconstructing the magnetic cores of the machine, a change in speed is requisite if the number of the poles is not to be altered, since the frequency is a function of the number of poles. Thus, if a 120-cycle generator is to deliver 60-cycle current the speed must be decreased by one-half. If the armature winding is not changed, the voltage will decrease directly with the speed, because the field magnetism cannot be increased appreciably on account of the saturation of the core. Since the armature current will be practically the same for a certain heating whether the speed be high or low, it follows that the capacity of the gen-

erator will decrease directly with the decrease in frequency. With respect to this latter statement, it is noteworthy that at the lower speed the armature iron losses are less than at the higher speed, so that the watts to be dissipated as heat are decreased; but this fact does not permit the current output from the armature to be increased appreciably for the reason that there is less opportunity for efficient ventilation of the core at the decreased speed. What precedes refers to a machine already constructed with a certain number of poles, and it is to be noted particularly that such a great variation in machine capacity does not exist between commercial machines of different frequencies when each has been specially designed for a certain frequency. In the latter event a change is made in the number of poles or the diameter of the armature so that each machine operates at a high peripheral speed and the capacity is largely independent of the frequency.

If it is desirable to have a machine operate at the original voltage when the frequency is changed from, say, 120 to 60 cycles, it will be necessary to rewind the armature so that there will be twice as many conductors in series as formerly. Since the size of the slots is limited, it will be found that each conductor must be made about one-half of its former size, so that the current which the armature can carry is one-half of its original value, and the watt capacity of the changed machine is one-half of that of the original machine. Many of the early high-frequency generators were wound with the armature coils in two groups connected in parallel. If the two groups be connected in series, then at half speed the machine will deliver full voltage at one-half the original frequency. Most of the older high-frequency generators were of the single-phase type, and relatively few motors were driven from them. The lower frequency generators of the present day are largely of the polyphase type and are intended to supply power to both lamps and motors. If a single-phase, 120-cycle armature is properly rewound to deliver two-phase, 60-cycle power its capacity will be decreased by only 29 per cent instead of the 50 per cent when it is rewound as a single-phase machine. This statement applies to a machine in which the slots are evenly distributed along the armature core, and in which the armature winding is of the closed-coil type, and it must be modified slightly if the machine is not thus constructed.

The effect of decreasing the frequency at which a stationary transformer is operated may be investigated in a simple manner as follows: If the core flux is to remain constant, then the capacity varies directly with the frequency, since the voltage depends upon the product of the frequency and the flux. In this case the iron will not reach an economical working temperature because the hysteresis loss changes directly with the frequency, and a 120-cycle transformer operated at half voltage as a 60-cycle transformer will be subjected to just 50 per cent of the original hysteresis loss. The eddy-current loss, which in any case is but a small part of the whole loss, will be decreased to 25 per cent of its former value. If the voltage is increased to the original value, then the core flux will be twice its original value and the hysteresis loss will be increased to $2^{1.6} \times .5 = 1.5$, approximately. Thus the original hysteresis iron loss will be increased by 50 per cent. The eddy-current loss, however, will not be changed. Almost all of the older 120-cycle (or 133-cycle) transformers were originally so designed that they could be subjected to this increased iron loss without producing excessive temperature rise, so that the decrease in frequency to 60 cycles produces nothing more detrimental than a decrease in the efficiency. In cases where it is desirable that the hysteresis loss remain constant with a change in the frequency, then the voltage of the transformer will vary as the three-eighth power of the frequency. If the total hysteresis and copper losses are to remain constant, then the capacity of the transformer will vary with the voltage; that is, with the three-eighth power of the frequency. If, for example, the frequency is changed from 120 to 60 cycles, the load capacity will be decreased to about three-fourths of its former value, the hysteresis and the copper losses remaining the same, and the eddy-current loss will be reduced to about 60 per cent of its former value.

The Conduct of a New Business Department.

The paper by Mr. S. M. Kennedy, of Los Angeles, which was awarded second prize in the competition instituted by the Co-operative Electrical Development Association, is printed in full elsewhere in this issue. Mr. Kennedy touches very briefly on one subject in connection with advertising to which we believe many companies should give more attention. Mr. Kennedy expresses the opinion that circulars and advertisements should "tell one thing at a time." We are aware there is considerable difference in practice of different companies in regard to circulars and advertising copy, but there can be little doubt that the advertisement which calls forcible attention to the advantages of one particular device is apt to be far more valuable than general advertisements which say but little. It is simply the old question of specific statements versus glittering generalities. The generalities may sound very well, but they do not sell the goods. The salesman who talks nothing but generalities does not stay in that occupation very long. Is it reasonable to expect that advertising, which is but another form of salesmanship, should be other than specific and to the point?

A very interesting proof of Mr. Kennedy's paper is the recital of his company's policy as regards electric irons for domestic use. A central station company with 10,000 flat irons on its circuits is certainly something to set one to thinking. This remarkable extension of service is being brought about by the loaning of irons to customers just as incandescent lamps are loaned by many companies when they furnish free lamp renewals. This naturally brings up the question whether ultimately a good many central station companies will not adopt this practice. The electric iron is certainly one of the best revenue producing devices in use among residence customers. The first cost of the iron is small compared with the revenue secured from its regular use. It is, furthermore, a revenue which involves no extra investment for generating and distributing systems. An iron, like a lamp, is easily removed or exchanged. Many companies are working hard to take on business which, when secured, will call for additional generators, transformers, and lines. An added load which calls for an investment of only six or eight dollars per kilowatt, as does the flat iron load, is certainly worth considering. Naturally, if customers can be induced to purchase irons and so relieve the company of this investment, so much the better; but it is a matter worth serious attention from every company whether irons may not be introduced and put in use with so much greater rapidity if furnished free, that the company will be the gainer by the latter policy. Of course, if a free flatiron policy is introduced, there must be safeguards to prevent a lot of irons being with customers who only use them rarely or not at all, thus causing a large idle investment. Taken all together, Mr. Ken-

nedy's paper is an excellent review of central-station business possibilities and is therefore of much value, although not perhaps containing as many specific suggestions as the first prize paper by Mr. Seelman, printed last month.

AN ELECTRIC FAN CAMPAIGN.

In a vivacious article on good central station advertising, in this issue, Mr. Seelman tells of a fan motor campaign carried out by the Brooklyn Edison Company last winter. A rich man being asked recently to explain how he did it, said that the secret lay in buying his straw hats in winter, and Mr. Seelman worked along analogous lines in getting the Brooklyn public to buy fan motors. A bargain was offered at a time when it was not wanted, and with the aid of a few thousand circular letters, folders and postal cards, footing up $75, no fewer than 1,300 fans were disposed of, or more than the company had purchased. This Mr. Seelman is fairly entitled to characterize as an "instance of practical, economical and successful special proposition advertising." It might perhaps be said that after all the company only anticipated its natural fan business in the spring, but that is not quite true. It cleaned up stock on hand, attracted attention by a novel proceeding, got a good many new fans on the circuits to consume current earlier than would be the rule, and relieved the company of undue pressure when the real "fan time" came around. At any rate, we commend the incident to the notice of central station managers, in case any fans are left on hand in the fall.

POLICY TOWARD THE PUBLIC.

"The Public Is Entitled to Kick," the catchy headlines of a billboard advertisement of the central station company at St. Louis mentioned elsewhere in this issue, is an expression which represents something more than merely the attempt of a clever advertising man to catch public attention. It represents a principle which is coming to be recognized more and more in the management of public service corporations. Some managers will doubtless say that they have enough unreasonable kicks from customers now without adding to the number by special invitation from the company. It is nevertheless undoubtedly true that an attitude on the part of the management and employes of the company that welcomes complaints and criticisms does much to temper these very criticisms and to make the company better thought of in its community. If a customer with a grievance, real or imagined, knows that he will receive scant courtesy if he makes that grievance known at the electric light office, he will invariably air it among his neighbors to the detriment of the company, rather than at the company's office. Furthermore, no company's service is perfect and no management is any too fully in touch with its customers. The welcoming of complaints tends to bring the management into better touch and enables it to give better service. When complaints are once received they should be given proper attention. If it is merely a question of defects these are easily remedied, and if a question about large bills, the complaint should be followed up carefully. It is not sufficient to make sure that a man's meter is correct and then tell him that he is simply paying for what he gets and cannot expect anything better with the installation he has. Someone who understands his business should go over the customer's installation and make some specific suggestion as to changes and improvements that will lead to better results and help him to carry them out if he so desires. It is not enough, for example, as we have sometimes known it to be done, to send an inspector to a man's house and later make a written report to the customer through the general office, this report being to the effect that the glassware is poor and the lamps are blackened. The inspector, or whoever attends to such things, should be able to make suggestions on the spot as to why the glassware is poor, what should be substituted in its place and what should be done about the blackened lamps.

THE CRISIS OF THE FLATIRON SEASON.

When this number reaches its central station readers, the electric flatiron season will be at its height. The numerous central station companies which have been introducing these irons in quantities during the earlier part of the summer will, during the coming month, learn how large a percentage of irons put out on trial are to remain in service. The percentage of domestic flatirons put out on 30 days' free trial that are returned, we find, varies considerably in different cities, running all the way from 5 to 30 per cent. Where the lady of the house does her own ironing the iron is much more likely to remain than where a cheap and ignorant class of household labor is employed. An argument frequently met with by those attempting to introduce such irons in the South is that they are too great a refinement to put in the hands of negro servants, who are accustomed to coal and wood fires. This argument is evidently based on a mistaken idea of the attention required by an electric iron. As a matter of fact, it is so safe and simple that it is not to be considered in the same class as other irons. There are many families in the smaller towns, both South and North, that would be glad to rid the kitchen of the coal range and use gasoline stoves were they not afraid to trust either themselves or servants with that dangerous fluid. The electric iron with its single safety requirement that it be not left standing anywhere but on its proper stand with the current turned on, offers a safe and easy relief from a hot fire every ironing day.

We have frequently during the past few months emphasized the importance of seeing that customers' irons are properly connected up for convenient use in the kitchen. There is another equally important point which should be looked after when an iron has been on trial for several weeks. This is to see whether the customer has obtained the proper size and weight of iron to give the best satisfaction. The common size of iron that has been introduced over the country for household use takes about 450 watts and weighs 5½ to 6 lb. Now this size of iron is ample for all light work or work where the ironing must be done slowly. For very rapid work, however, and where large pieces like tablecloths are included in the washing, a 450-watt iron will not supply heat fast enough. The result will usually be that the iron will go out of use and no one, not even the operator, will be able to state what the real trouble was. Every central station company which is introducing domestic irons should keep on hand several sizes and should be prepared to deliver heavier irons promptly as soon as any little dissatisfaction with the usual 450-watt size is found. We have also heard of cases where electric irons were not giving satisfaction in laundries for the simple reason that the irons were not of sufficient capacity to do the rapid work required in laundries. A central station company can afford to do considerable nursing on so profitable a business as that offered by electric flatirons.

Abandonment of Glasgow Municipal Telephone System.

As already noted fully in these pages six years ago the city of Glasgow embarked in the telephone business, establishing a municipal plant to compete with the service of the National Telephone Company. The enterprise has been a complete failure, and on July 6 the Town Council of Glasgow sold its telephone business to the post office at a loss of $200,000. In regard to this matter the Glasgow *Herald* of the same day says editorially: "The Town Council of Glasgow yesterday wisely resolved to retire from the telephone business. It is six years since the funds of the citizens and the security of the rates were pledged to a competition with a private undertaking—which may have been faulty, but was certainly willing and able to mend, as it did in point of fact. The whole five years that the corporation system has been in actual operation under license have resulted in what ordinary traitors would regard as dead loss. After an expenditure of some £360,000 in building up the system, it is now necessary to expend another £100,000 on alterations and extensions to meet the circumstances of the day. There is no probability of profit in the increased capital outlay, and the license expires in another seven years. The telephone department must, therefore, either be wound up on the best terms obtainable or continued after additional capital expenditure at an increasing loss to the rate payers.

"In the circumstances, the Town Council has decided wisely to sell out the whole concern and be done with it. It has agreed to accept the offer of the postmaster-general to pay £305,000 for the entire undertaking, with the exception of the stores and tools, which will be taken over by the government at cost price. The alternative was to dispose of the concern to the National Telephone Company, to compete with which the municipality went into the business.

"The undertaking was a mistake from the beginning and has always been objected to here. We do not now, however, jeer at its advocates, but confine ourselves to an expression of gratefulness that this error in municipalization has escaped with mild punishment."

The apparatus put in was what is known in America as the "Law system" was a separate return calling wire, and its inevitable failure was freely predicted by experts on both sides of the Atlantic.

Telegraphy in the Isle of Pines.

Note has been made in these pages of the arrest and imprisonment of American citizens in the Isle of Pines, Cuba, for installing a private or "toy" telegraph line, because it infringed a government rule and monopoly. The following special dispatch from Havana throws more light on this interesting incident. It says: "The release and pardon of three Americans who had been imprisoned on the Isle of Pines closes an episode which had begun to attract widespread attention. The story is a simple one. Among other Americans who had cast their fortunes on the Isle of Pines were these three: Miss Millie Brown, H. S. Augustine and H. L. Giltner. Giltner was postmaster at Columbia. His assistant was Miss Brown, who was, it is said, also his fiancée. Augustine conducted a general store in the village. One day an agent of a telegraph company invaded the little American colony. The promoter of electric enterprise persuaded several to have instruments installed in their houses, and among others the three mentioned succumbed to the blandishments of the agent. Lines were run and the toy instruments installed. Then came trouble. The first intimation of it was when Miss Brown was arrested. Her mother had just gone to the States, leaving the household in her charge, and she had therefore little time to experiment with the toy telegraph, and which seems to have been installed for amusement and diversion.

"Giltner and Augustine were also arrested at the same time, and all three were taken to jail, and charged with a violation of an order issued by Gen. Leonard Wood when he was Military Governor of Cuba, which forbade the establishing of any telegraph or telephone communication without proper authority. These offenders had had no warrant for wire service. They got the option of paying a fine or expiating the offence in jail. They chose incarceration, their plea being that in operating a private wire over private lands and into private houses was no breach of the law, whatever its application.

"The imprisonment of the three caused intense excitement on the island, and it was violently asserted that the military order requiring government permit for a telegraph line was not intended to apply to such a case. It was admitted that the letter of the law had been violated, but it was asserted as no less true that its spirit had not been, and the indignation that was felt was reflected in a memorial that was addressed to Senator John T. Morgan.

"Release of the three was brought about through the intervention of the American Charge d'Affaires, who obtained a promise from the prisoners that they would not again attempt to violate the law by employing toy telegraphs for their own amusement. Americans in Cuba are somewhat disquieted by the incident, and resent the action of the Cuban authorities. They say it is very doubtful if the order of General Wood is now in force or is any part of the law of the land. While admitting that Americans visiting or resident in Cuba have been treated fairly, they do not believe that Cubans guilty of an offence similar to that of Miss Brown and her colleagues would have been interfered with. The affair is characterized as too trivial for the government of Cuba to notice. There is known to be considerable feeling on the part of Cubans and the Cuban government against Americans on the Isle of Pines."

The Power Plant of the Western New York and Pennsylvania Traction Co.

The Western New York & Pennsylvania Traction Company operates and controls 100 miles of traction lines in and connecting Olean and Salamanca, N. Y., and Bradford, Pa., with spurs to adjacent towns. The road between Olean and Bradford passes through the oil fields of Rock City at an elevation of nearly 2,400 ft. At Ceres, N. Y., 12 miles from Olean, the company is building a generating station 65 ft. by 107 ft., one story and basement in height, of steel construction imbedded with concrete, with brick upper walls and slate roof.

The power plant and electrical equipment of this station will consist of four 500-hp gas engines running at 150 r.p.m., direct-connected to 300-kw, 25-cycle, three-phase alternators. The engines are being furnished by the Westinghouse Machine Company and the Snow Steam Pump Company; the Westinghouse engines are four tandem double-acting cylinders 22 in. by 30 in. The Snow engines are four double-acting cylinders 22 in. by 30 in. arranged two in parallel with cranks 90° apart. These gas engines will operate on natural gas of the high value of 1,000 B.t.u. per cu. ft., which is obtained from the company's own gas field adjacent to the plant. The company's experts figure that there is an unlimited supply of this ideal fuel. This is the first distributing power station, it is believed, to use gas engines operated by natural gas. The cooling water is obtained from four artesian wells, driven for the purpose, to which are attached two motor-driven Worthington pumps of 16,000 gal. per hour capacity.

The exciting current is supplied by two 85-hp gas engines direct-connected to 50-kw, 125-volt generators; air compressors for furnishing power to start the 500-hp units are belted from these engines. The main generators operate at 370 volts, supplying current to a 300-kw rotary in this station, the balance of current being stepped up to 22,000 volts for transmission to sub-stations at Olean, Rock City, Bradford, Carrollton and Salamanca. At these sub-stations the initial installations will be two 300-kw rotaries at Bradford and Olean and one 300-kw rotary at each of the other stations with provisions for the second. All transformers are supplied with double secondaries and half-voltage taps, thus allowing two rotaries to be run off one bank of transformers. Three 220-kw, single-phase trans-

formers are installed in the stations with the two rotaries, and two transformers in stations with a single rotary. The third transformer is to be installed when the second rotary is installed.

All transformers and rotaries being similar, reserve is taken care of by a spare armature and field coils which can be sent to any station. Owing to the relative location of these towns, one of the single rotary stations could be temporarily shut down without seriously impairing the service.

The transmission line where the road operates over private right of way is on the same poles with the 600-volt feeder, at other points the transmission line is on a private right of way.

All work is being carried on from plans prepared by and under the direction of E. C. Tibbals, the company's electrical engineer, and all the electrical apparatus is of General Electric make.

The Springfield Meeting of the New England Electric Lighting Engineers.

The Association of Electric Lighting Engineers of New England held its midsummer meeting at Springfield, Mass., on July 28. About 125 members and guests were present and the programme included a two-hours' morning session in Memorial Hall, a luncheon at its conclusion, and a trolley trip in special cars to the Birchem Bend, Indian Orchard and State Street power stations of the United Electric Light Company, whose guest the association was during the day. In the evening a large party was entertained by a trolley trip to Mt. Tom and a dinner on the summit given by the Springfield Gas Light Company. The gas plant in Springfield was opened for inspection during the afternoon.

Three topics were slated for discussion at the morning session, which was called to order at 11.50 o'clock by President W. C. Woodward. The discussion was informal, the first matter considered being "Artificial Refrigeration." Mr. R. W. Rollins stated that the Hartford Electric Light Company now has ten electric refrigerating plants in operation, the motors varying from 1 to 15 hp in size. The yearly income from these plants up to July 1 has been about $5,000. Four plants have been installed this summer in Hartford. The business is exceedingly attractive because it increases the summer load at a time when the lighting load is very low, and it tapers off gradually in the fall as the days grow shorter and the lighting peak increases. The company makes a price of about 3 cents per kw-hour for this class of service, and the result is a notable economy over the cost of ice, particularly in a season like the present one, which succeeds an unusually open winter. The apparatus starts and stops automatically. A recording instrument in the 5-ton plant of the Hotel Heublein, Hartford, showed that on July 20 and 21 the apparatus was in operation about 75 per cent of the time. These days were very hot and the demand for refrigeration was therefore especially large.

Mr. Walter R. Eaton, of the Cambridge Electric Light Company, said that his company has installed a 7½-ton plant in a large market, driven by a 15-hp, three-phase motor, which also drives a small lighting outfit. This plant is of the type in which brine is circulated after being cooled by expansion coils, and it operates 24 hours per day. The rooms cooled consist of a meat room, which is cooled to 35° F.; a 12-ft. by 10-ft. freezing room, temperature 20°; a 16-ft. by 16-ft. butter and cheese room kept at 37°; a 14-ft. by 12-ft. vegetable room kept at 40°, and a 10-ft. by 10-ft. fish room cooled to 45°.

Last year the market used ordinary ice and its ice expense amounted to $11.44 per day at the prices then prevailing. The cooling of the meat room alone last year cost $5.72 per day. This year, with energy at 2½ cents per kw-hour the total cost of cooling the plant is $4.02 per day of 24 hours, which means a saving in refrigeration expense of $7.42 per day, comparing last year's figures of ice with this year's expense for electric energy. The lighting plant runs 12 hours and adds about $1.62 per day to the total cost of refrigeration. It is safe to say that under present conditions the cost of cooling by ice is from two to four times as expensive as the cost of refrigeration by electricity.

Mr. G. R. Stetson, of New Bedford, cited a 15-hp motor-driven refrigerating outfit in a market in his city which was formerly operated by a gas engine. About 2,736 cu. ft. of space is cooled, and in the display room is a counter 60 ft. long cooled by 600 ft. of 1-in. pipe. Last year the ice bill of this market at $2.25 per net ton was about $685, and this year the cost of ice per ton is about double last year's figures. With energy at 3 cents per kw-hour this year's refrigerating expense is about $1.47 per day; so there is no question about the commercial economy of the installation.

Mr. J. W. Cowles, of Boston, stated that the Edison Company of that city has a number of refrigerating plants in the market district, but the situation is complicated by the sale of cold storage by private organizations working on a steam basis in the Atlantic Avenue section. Mr. C. H. Herrick, of Boston, said that the largest refrigerating plant on the Edison circuits in Boston is that of Marston's Restaurant on Brattle Street, which plant is driven by a 65-hp motor. There are no automatic plants in service as yet, for all the installations run continuously. The refrigerating plants run on the regular meters and demand system, and the usual power rates of the company apply to this service.

Mr. W. P. Eaton brought out the additional point that cuts of meat are always dry with an electric refrigerating plant, whereas it is impossible to keep the meat from getting damp or slimy by using ice in the ordinary way. He further said that the low rate given to the Cambridge market is the result of the power load which the customer has, aggregating 42 hp in connected motors. Mr. Herrick emphasized the fact that cuts of meat remain fresh one or two days longer with electric refrigeration when exposed in a glass case with coils below.

The next topic was "Change of Frequency and Voltage." Methods of changing over from high frequency low voltage to low frequency high voltage without interrupting the service at critical times were discussed. The general experience was that unless decided improvements in the operating efficiency of the new apparatus could be guaranteed the customer, the expense of making the change had to be borne by the company. It is almost invariably the case that a customer who looks upon his installation on one day as antiquated and more or less fit for the scrap decides that it is in amirable condition for long future service as soon as it is suggested that he bear a share of the cost of changing over the system to a more modern layout. As a rule a customer becomes in a measure attached to his motor or motors, and is not at all anxious to pay even a part of the cost of substituting more modern equipment. Sometimes one circuit at a time is changed over; sometimes special transformers are inserted temporarily and sometimes a part of the system will be changed over on a Sunday, or other time of light load, in order to interfere as little as possible with the service. In one case where 125-cycle Riker dental motors were placed on a 60-cycle power circuit, the change was made by adding a choke coil costing only $8 or $10 per motor. This increased the reactance and held down the rush of current which would otherwise have injured the motor on account of the reduced impedance resulting from the substitution of the lower frequency from the higher.

The final subject discussed was "Rates." The advantages and disadvantages of differentiating power and lighting rates were touched upon, and the point was brought out that very careful analysis is needed to make it clear to different customers why rates vary so widely in the same community. It is highly essential to point ou the justice of readiness-to-serve charges, to show the necessity of charging more for short-hour service at the time of the load peak, and to withstand the imposition of a legislative maximum rate. A new method of taking care of the minimum monthly charge per motor was given by Mr. R. S. Hale, of the Boston Edison Company. It consists in giving all motors a lighting rate of 15 cents per kw-hour until $2 per hp per month is consumed, when the discounts come on, making the unit rate per month low. Mr. W. H. Coughlin, of Worcester, sounded a warning note against too great a discrepancy between lighting and power rates, in view of the difficulty of making the subject

clear to the public. Examples of power rates were given by other managers, some running with very large consumers and water power as low as 1¾ cents per kw-hour. The meeting closed with a rising vote of thanks to the United Electric Light Company for its greatly enjoyed hospitality, which was directed by Manager W. L. Mulligan, with the assistance of Messrs. F. N. Fowler, Bennett, Scott, Yunker, Parkhurst, Willston and Selden, of his staff.

Elks' Convention in Denver.

The illumination of Denver during the Elks' convention, which was held there during the week beginning July 16, was in the

FIG. 1.—OFFICE OF DENVER GAS & ELECTRIC CO.

opinion of the visitors to the city the most artistic and the most richly diversified ever seen at any Grand Lodge reunion in the history of the order. The host of visitors was unanimous in declaring that Denver is justly entitled to its widespread fame as the "City of Lights" and every person in attendance at the

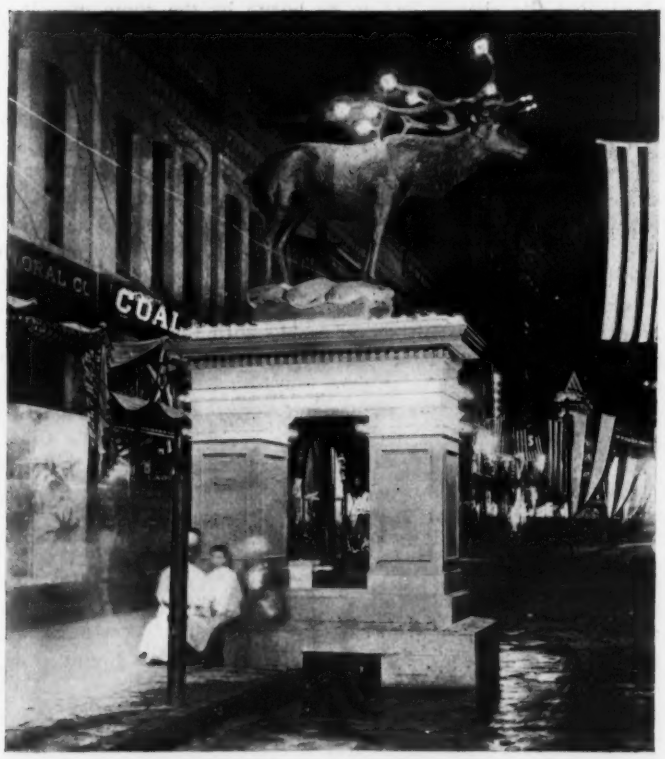


FIG. 2.—ELKS' ARCH.

convention will be inclined to boost decorative lighting, so great was the impression made by the elaborate display. The Denver lodge of Elks spent a considerable sum on its own account to eclipse all other conventions in decorative lighting, and their efforts alone will long stand as a monument to their enterprise. But the merchants of the city loosened their purse strings as they never did before during a convention, and the result was a splendid and most effective illumination of all the large places of business.

The welcome arch at the union depot was the first piece of lighting to greet the visitors and the comments made upon its beauty evidenced the appreciation which it earned from every one who stepped within the city's gates. Looking up Seventeenth Street there seemed to be a regular roof of multi-colored lights

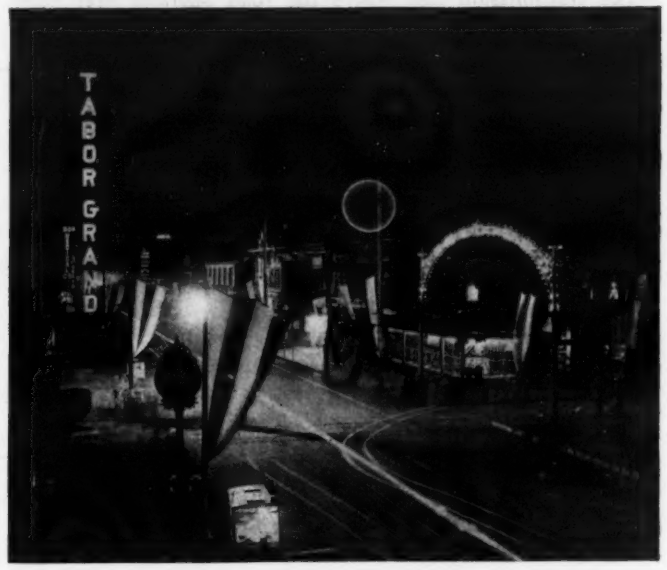


FIG. 3.—VIEW AT SIXTEENTH AND CURTIS STREETS.

with the Elk purple lamps as the dominating color. This effect was produced from the strings of lights stretched across the intersections of the streets. This same scheme was followed on Sixteenth and Fifteenth Streets and the whole made the down-town section as bright as day.

CURRENT NEWS AND NOTES.

DETROIT TROLLEY FRANCHISE.—Mayor Codd and President Hutchins, of the Detroit United Railway, have agreed to the terms of a new street railway franchise for the Detroit United Railway. The company will make a number of important concessions, including an offer of ten tickets for 25 cents during workingmen's hours, six tickets for 25 cents at all other times and general transfers. The railway will also pay for all paving between the tracks and a 2 per cent tax on its gross earnings. All of the franchises will be extended for fifteen years, after which the city will have the right to buy the property.

GETTING READY FOR ELECTRIFICATION.—Great preparations are now being made in the vicinity of New York for the electrification of the main lines of railroad. Fifteen hundred men are working day and night on the main line of the New York, New Haven & Hartford Railroad to complete its electrification between Stamford, Conn., and Woodlawn, N. Y. Notices have been posted in the Harlem River yards calling on engineers to file bids for running the motor trains, beginning on September 3. Notices were also posted asking firemen now in the employ of the company to file bids as assistant motormen. It is planned to have two men in the cab of each motor train. The duties of the assistant engineer will be to keep a lookout while the train is in motion and to be ready to step into the motorman's shoes should an emergency arise. The motormen and assistant motormen will be paid at about the rate now paid engineers and firemen on the Stamford-New York run. If the call for bids from engineers does not result in the filing of applications from enough to man the controllers, the vacancies will be filled from the ranks of the firemen now in the company's employ. It is not believed, however, that there will be difficulty in recruiting the full force of motormen from among the engineers.

TELEPHONY IN NEBRASKA.—An organization has been effected at Beatrice of independent telephone interests in Nebraska around that city, making a fifth district. It is said that the organization in the county includes 2,000 telephones and in the State 17,000.

TELEGRAPHY IN EUROPE.—United States Consul-General Guenther reports from Frankfort that among the European states Russia has the largest telegraph lines, a total of 175,000 km. (109,375 miles); France has 150,000 km. (93,750 miles); Germany, 134,000 km. (83,750 miles); Great Britain, 79,000 km. (49,375 miles).

SOUTH AMERICAN PLANTS.—It is reported in the consular notes of the Department of Commerce and Labor that the municipality of Montevideo, Uruguay, has authorized the Empresa de Luz Eléctrica to adapt their plant to supply power for electric trams. The Liga Comercial, of Mar del Plata, Argentina, has applied to the Compania de Electricidad del Plata for extension of the electric lighting service.

RAILWAY TRAIN LIGHTING.—With reference to our recent article on the train lighting of the Chesapeake & Ohio Railway Company, we are advised by Mr. J. F. Walsh, superintendent of motive power of the system, that it has the axle lighting system of the Consolidated Railway Electric Lighting & Equipment Co. on nine dining cars, one postal car, one business car, two sleepers, thirteen coaches and two parlor cars. Under order there are axle lighting equipments for eighteen coaches, one dining car and two parlor cars. All these are furnished with sets of "Chloride" accumulators, which are also in use on two of the straight storage battery cars.

WIRELESS IN RUSSIA.—Special advices from St. Petersburg of July 27 say: "To prevent being cut off from telegraphic communication with the country and with the outside world, as it was during the big strike last year, the Russian Government has recently established many wireless stations. The work has been done secretly, so far as possible, and its significance is obvious. Between St. Petersburg and the German frontier a powerful Marconi system has been installed. One station is close to the capital and the other is in a frontier town on the Baltic, with a relay at Reval. Fortress and garrison towns of Finland have also been linked with St. Petersburg by wireless telegraph in a very thorough manner."

DEVELOPMENT AT HANKOW.—United States Consul-General William Martin, of Hankow, responds to a New York inquiry as follows: Up to date there has been little or no demand for pipe-cutting and threading machines, etc., in this Chinese city. All water has been carried by coolies from the great Yellow River, and the darkness has been illuminated by Standard oil. Hankow, however, is growing rapidly and becoming a city of great importance for shipping and export, hence public conveniences are in order. An electric light plant is being constructed and strong efforts are being made to have a water supply for the entire city. These will create openings for American products relating to these enterprises.

TELEPHONE RATES IN GEORGIA.—A hearing has just been closed in Georgia in which the Secretary of State, J. Bryan Grimes, had filed a complaint before the corporation commission, to the effect that the Bell Telephone Company's rates are too high and that the company has a monopoly of the business in the State. Many witnesses have been examined, including officials of the Bell company, and officials of independent companies, and the decision of the corportion commission has been put off for one month, before they make answer. The hearing went into the minutest details of the operation of telephone companies, and included every item of expense. Mr. Hugh Chipley, of Atlanta, general counsel for the Bell company; General Manager Gentry, of Atlanta, and others, prominent in business life, were before the commission and closely examined.

WIRES IN CONNECTICUT.—The subject of overhead wires is receiving attention in Connectitut and Mayor Studley, of New Haven, proposes that the State Assembly pass a general law as to placing all wires underground, particularly those for telegraphy and telephony. It is stated that the Southern New England Telephone Company suffered tremendously from five storms in July alone. This company is not waiting for municipalities to take the initiative in this matter. By the end of this season it will have laid 415,000 ft. in new conduits, distributed in Connecticut cities as follows: Ansonia and Derby, 18,000 ft.; Hartford, 75,000; New Haven, 125,000; Bridgeport, 25,000; Meriden, 40,000; Norwich, 50,000; South Norwalk, 25,000; Stamford, 10,000; New Milford, 10,000; Danbury, 21,000; Willimantic, 3,600; Waterbury, 7,000; Milford, 2,500; Ridgefield, 3,200.

RAILWAYS IN JAPAN.—The Japanese Government is taking over the railways in the empire and will, it is rumored, also acquire the trolleys, prior to a general electrification, for which abundant water power exists. But it is said that the residents, native as well as foreign, have abundant reason for disapproving of the scheme of state control, for the reason that one branch now belonging to the government—that from Tokio to Kobe—is a model of mismanagement. Sleeping accommodations must be reserved days ahead; the cars, even those of the first class, are overcrowded, and the officials are careless about attending to their duties. There is no consideration for non-smokers, though the natives of both sexes smoke incessantly. Heating and lighting are of the most primitive description. It is feared that state control will reduce all the roads to this level, and that the rates will be raised, as a new form of taxation. The value of competition is illustrated on the line from Tokio to Yokohama, which, for the first time, has put on real express trains that cover the distance in half an hour; the cause of this new departure being a rival electric line.

WIRELESS AROUND LONG ISLAND.—It is stated that in order that messages may be sent direct from the Brooklyn Navy Yard to ships 300 miles out at sea or to the Navy Department in Washington, the local wireless telegraph station is to be greatly improved. For the purpose of installing a continuous line of service along the Atlantic coast to communicate with United States warships, the wireless station at Atlantic Highlands will be discontinued, and the station at Montauk Point will be moved to Fire Island on the south shore of Long Island. It has been found that Montauk Point is not a suitable place for a wireless station because of the sandy ground, and as messages are more satisfactorily transmitted over water than over land, the proposed station at Fire Island will be a great improvement. It is said that on account of the hills between New York and Montauk Point it has often been impossible to communicate with that station from New York, so that the present service is practically of no value, as it cannot be depended upon. Many times the Navy Yard has been unable to communicate with the ships of the North Atlantic Squadron at Newport by way of Montauk, but messages are easily sent by way of Fire Island.

BROTHERHOOD OF SCIENCE.—Commenting on recent events in England, the *Evening Sun* says: "The pleasing task of promoting international amity and the brotherhood of man is apparently not to be monopolized by Peace Conference delegates or after-dinner orators at Anglo-American dinners, for European dispatches and letters indicate that our keen-minded engineering men are very busily establishing an internatioal cordiality that is more concrete and more practical than any scheme suggested at the recent Interparliamentary Conference. At present a party representing the American Institute of Mining Engineers is being entertained by the British Iron and Steel Institute and were received by King Edward to-day. Earlier in the month the British Institution of Electrical Engineers, with an entertainment fund reported to amout to $100,000, acted as host to a large number of visiting electrical engineers, including fifteen members of the American Institute of Electrical Engineers, and still larger delegations from the electrical societies of France, Germany, Italy and Switzerland. After several days in London the visitors were taken on a ten-day tour of England and Scotland, the itinerary being so arranged that visits to representative engineering works, power plants and shipyards, were pleasantly mingled with less fatiguing trips to places of literary or historical interest."

DYNAMITING DYNAMOS.—An attempt was made last week to blow up the municipal lighting station at North Baltimore, Ohio. A bomb was placed in the fuel, but was discovered by the engineer. A test proved that it contained dynamite enough to have blown the station into small pieces. Just what the grudge was is not stated.

A NOVEL DINNER.—At Torrington, Conn., recently eighty of the leading business men were guests of the Torrington Electric Light Company at a banquet. The affair was arranged by the officials of the company in recognition of the generosity of the business men in providing a fund by subscription to enable the company to install an extra service for the business portion of the borough, a matter which the borough board had not authority to assume without a vote of the borough.

AN ELECTROPLATE ANNIVERSARY.—We did not know that the art of electroplating was a hundred years old, but the following item is interesting in the daily papers: "On the occasion recently of a centenary celebration by a London firm of electroplate makers, in which 850 employes took part, it was stated that there were now eighteen men and women who had been in the service of the firm from 56 to 60 years, thirty-eight from 45 to 50, and fifty-seven from 30 to 40 years."

WOMEN IN ELECTRICITY.—In various branches of practical work in electricity women have already made a success, and have managed telegraph and telephone offices, electric railways and electric light plants. At the recent meeting of the National Electrical Contractors' Association, in Cleveland, the fact emerged that there are now two women in its membership who have achieved place and success in the contracting business. These ladies are Miss Rose B. Richardson, of Syracuse, N. Y., and Mrs. C. Fred Warner, of Rockport, Ill., whose firm bears her name. Both were in attendance at the convention and both took part in the business meetings.

DISPATCHING TRAINS.—The railroad accident bulletin, which has just been issued by the Inter-State Commerce Commission for the three months ended March 31, 1906, shows the total number of casualties to passengers and employes to be 1,126 killed and 17,170 injured. The bulletin says: "The most disastrous accident reported in the present bulletin, a collision causing 34 deaths and injuring 24, was due to the striking failure of the train dispatching system. A telegraph operator at a small station, who had been on duty all day and more than half the night, fell asleep, and on awakening misinformed the train dispatcher as to what had occurred while he was asleep."

GERMAN AIRSHIPS.—A company has been formed at Berlin having for its object a series of experiments with motor airships. The Emperor's influence directly brought about the movement to make a systematic investigation of air navigation, and, with practically unlimited capital, to experiment with motor airships. Admiral von Hollman was elected president of the company. The directors are Herr Rathenau, Dr. Althoff, Director of the Ministry of Public Worship and Instruction; Ernst Borsig, a manufacturer of locomotives; Baron von Brandenstein, Ludwig Delbrueck, Herr Schwabach, of the Bleichroeder Bank, Herr Loewe, of the Mauser Rifle Company, Wilhelm von Siemens, James Simon and N. T. Boettinger. Captain Richard von Kaehler, an engineer of repute, was elected business manager.

TRAIN TELEPHONY.—It is stated that telephone service has been established on all freight trains of the Galveston, Harrisburg & San Antonio between San Antonio and El Paso, and it is now possible for a train crew any place along the line to get connection with the train dispatchers along that division. The service is of the greatest value when a freight crew is caught out on a blind siding. He can get connection by the telegraph wire and receive his instructions from the dispatchers. In case of a wreck he can immediately telephone for assistance or instructions. Each caboose is equipped with a telephone instrument. With an extension fishing pole arrangement the conductor can make connections with the railroad telegraph wires and reach the office he desires. At the same time the telephone is in use, messages can be transmitted by telegraph and neither message will cause interference with the other, each message being transmitted as though the other were not being sent.

NIAGARA POWER IN CANADA.—At a meeting of the Ontario Hydro-Electric Power Commission, held in Toronto, it was decided to ask the companies developing power at Niagara Falls and the Cataract Power Company of Hamilton, developing at Decew Falls, for the price of a minimum of 10,000 hp at their development stations stepped up for long-distance transmission. The companies were asked to furnish this information on or before August 1, as the commission desired to be able by that time to quote figures in reply to specific requests from a number of municipalities to be furnished with power. From the figures so furnished and the figures already given by the commission in its reports as to the cost of power and its transmission, the municipalities will know whether they can get power delivered within their boundaries at satisfactory prices through the companies, or whether they will ask the commission to furnish it to them under the bill of last session. This measure, it will be remembered, gives the commission authority to develop and transmit power itself, or to expropriate existing plants, or to take power produced by them and deliver it, the commission controlling the rates.

MOUNTAIN TELEPHONE LINE.—An interesting telephone line has recently been erected on Greylock mountain, Adams, Mass. The line is built on poles to the base of the mountain, where the wires then run through an inch steel pipe. The pipe is strapped to the solid rock in the center of the large landslide, that occurred during the fall of 1901. The steel straps are riveted to the rock, holes having been drilled for that purpose. There are 2,800 ft. of wire in the pipe. At the top of the land slide the wire comes out of the pipe and is strung on poles to the summit. The poles used on top were cut there and are of spruce. Some of them are set in six feet of solid rock. In the pipe that is on the slide there are hand holes 300 ft. apart to permit of repairs. They have coverings like a lid. In order to ground wires in time of lightning and prevent discharges in the "central" at Adams, whence the line extends to the summit, two poles at the base of the slide are set in eight feet of water and about 50 ft. of wire is coiled about to take the effects of the lightning should a bolt hit the line. Mountain climbers are warned against using the pipe in climbing, especially during thunder showers, when they might receive fatal shocks.

ELECTRICAL FIRES.—The Electrical Bureau of the National Board of Fire Underwriters in its report of the electrical fires during the quarter ended July 10 gives the following summary: "Twelve fires have been reported as caused by high-tension lines falling across lighting and telephone circuits. Losses as far as given, $49,350. Grounding of lighting and motor circuits has been responsible for twelve fires. Aggregate losses, $28,757.75. Short-circuits on interior wiring caused twenty-three fires, with total losses of $14,906. Electric flatirons caused three fires; losses, $2,000. Motors caused nine fires; losses, $11,325. Rheostats, six fires; losses, $10,250. Overfused circuits, three; total losses, $330. Blown fuse, one fire; damage, $2,000. Lamp cord hanging on nail, etc., caused four fires. Nine other fires from a variety of causes, all proved to be electrical, resulted in losses of $211,500. Sixteen other fires were at first reported as due to electricity, but upon further reliable investigation by the inspectors have been found due to other causes. The losses on these fires amounted to $284,048. All of the fires summarized above have been reported to this bureau by inspectors. In addition seventy-nine accounts of supposed electrical fires have been received in which the causes were given as 'crossed wires,' 'defective wiring,' etc. Of these fires no more denite information has been obtainable. The aggregate losses on these fires was $884,205."

System of the Rockland Light and Power Company.

THAT central station operation is profitable in districts sparsely settled and with little or no manufacturing industries is proved by the Rockland Light & Power Company, of Nyack, N. Y. The system of this company covers the Palisade district on the west bank of the Hudson River, from Haverstraw, N. Y., to Harrington Park, N. J., and from the river to Monsey, N. Y. The territory covered is made up for the most part of residences and farms, the only manufacturing town being Haverstraw, whose chief industry is the manufacture of brick. The power house is located at Orangeburg, N. Y., and supplies two-phase current for all purposes, the electricity being transmitted by high-tension feeders to the various distribution centers and there stepped down by transformers to voltages suitable for commercial, private and street lighting circuits. Northvale, Norwood, Closter, Demarest, Cresskill, Alpine and Harrington Park, all towns in Bergen County, N. J., are supplied with single-phase current, while Tappan, Sparkill, Piermont, Grand View, South Nyack, Center Nyack, Upper Nyack, Orangeburg, Blauvelt, Munsey, Spring Valley, Pearl River, Nanuet, New City, Bardonia, Haverstraw, West Haverstraw, Congers, Valley Cottage and Garnersville, all towns in Rockland County, N. Y., are supplied with two-phase and single-phase currents. Constant-current alternating, enclosed arc lamps are employed in the Nyacks and at Haverstraw and these are fed from tub transformers. A fairly good motor load is carried during the day, the majority of the motors being of the polyphase constant-speed induction type. These motors furnish power for operating various machine shops and factories within the territory covered by the company's distribution lines. There are in addition quite a number of small single-phase motors used for operating various kinds of machinery in confectionery shops and for operating pumps in hothouses.

The power station at Orangeburg contains two 400-kw, 3,300-volt, two-phase, 60-cycle Westinghouse turbo-generator sets, one 100-kw motor-generator set, one 180-kw and one 125-kw Stanley inductor type alternators, one driven by a Westinghouse compound engine and the other driven by a McIntosh & Seymour engine. Both of these outfits are belt-connected. Steam at a pressure of 125 lb. is furnished by a 875-hp boiler plant located in one-half of the station building. Water-tube boilers of the B. & W., Heine and Caldwell types are installed and one 70-in. horizontal return tubular boiler supplies steam to the auxiliaries. An additional Heine water-tube boiler is at present being set up. Provision is made in the plant for superheating the steam supplied to the turbine equipment. For this purpose an independently-fired superheater is installed in the boiler room and connected to an 8-in. main steam line in such a manner that by opening and closing certain valves all steam coming from the boilers may be deflected through the superheater. If it is desired to use saturated steam the superheater is by-passed. The superheater is of the type supplied by the Power Specialty Company and differs somewhat from the Schmidt type used by some American boiler makers in that the superheating surface is supplied by numerous radial ribs cast upon the periphery of a number of

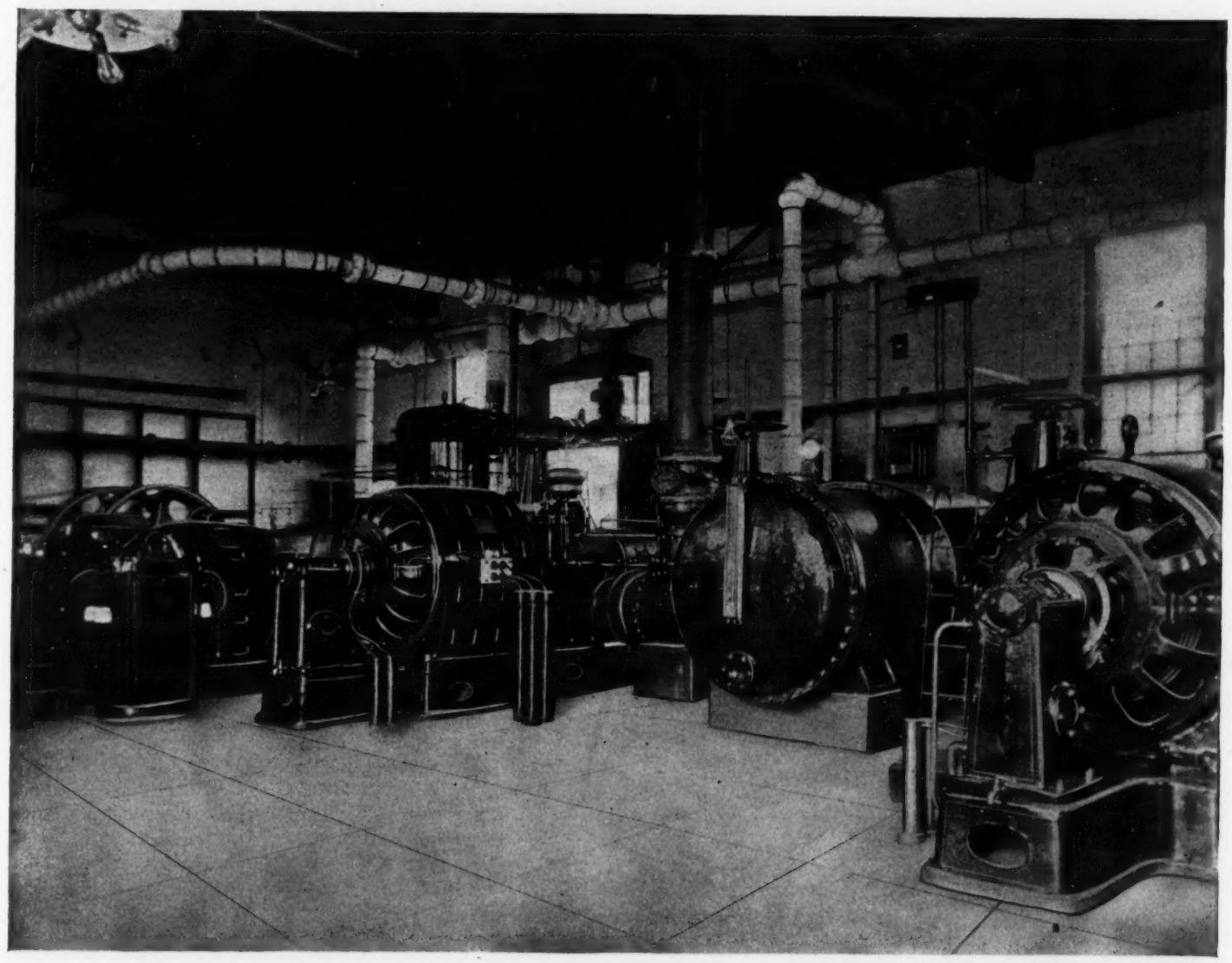


FIG. 1.—INTERIOR VIEW OF THE ORANGEBURG STATION OF THE ROCKLAND LIGHT & POWER COMPANY.

round cast-iron pipe sections arranged zig-zag within the superheater setting. Flat grates are used and the same grade of fuel is used as is employed in firing the boilers.

Natural draft is furnished by a brick stack into which the sheet steel smoke flues from the various boiler setting empty. There is also available for use during heavy periods of load an American Blower Company mechanical draft outfit which assists the main stack by drawing from the main flue a portion of the burned gases and discharging them into an auxiliary steel plate stack near the main stack. The fan intake is controlled by a butterfly damper located at the junction of the fan intake with the main flue. Coal is brought to the station upon an elevated spur track connecting with the main lines of the West Shore and the Ontario & Western Railroad, which pass very close to the station. The fuel used is a mixture of anthracite barley and bituminous; the former costs at the station on an average of 96 cents per thousand pounds, while the latter costs $1.68.

Owing to the lack of sufficient floor space in the engine room for the installation of an engine-driven generator outfit of suitable capacity it was necessary to install turbo-generators, and since the first unit was installed the distribution system has increased so rapidly both as regards the area served and the aggregate load that the other turbo-generator unit was installed. The latter unit was intended to displace the inductor alternators with their engines; but the dismantling of the Haverstraw station and its conversion into a sub-station have necessitated holding this equipment as reserve.

Usually in plants of this description surface condensers are

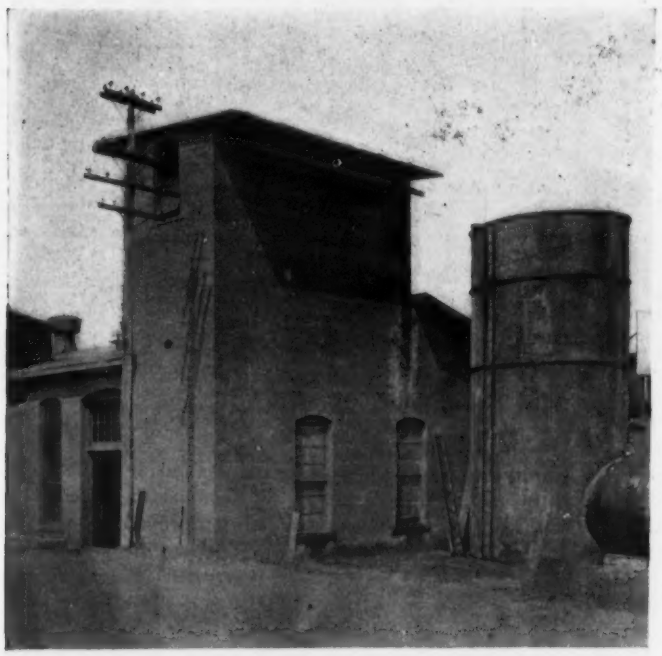


FIG. 2.—WIRE TOWER AND FAN DRAFT COOLING TOWER.

employed in order that the condenser steam may be returned directly to the boilers so as to avoid the cost of water and its purification where this is necessary. At this plant, however, comparatively pure water is found in a stream passing the power house a short distance away, and the condensing equipment installed previous to the installation of the first turbine was retained. This consists of an Alberger jet condenser with direct-acting air pump. Outside the engine room is located an Alberger fan-draft cooling tower, which during the normal operation of the plant serves the jet condenser. The fan shaft extends

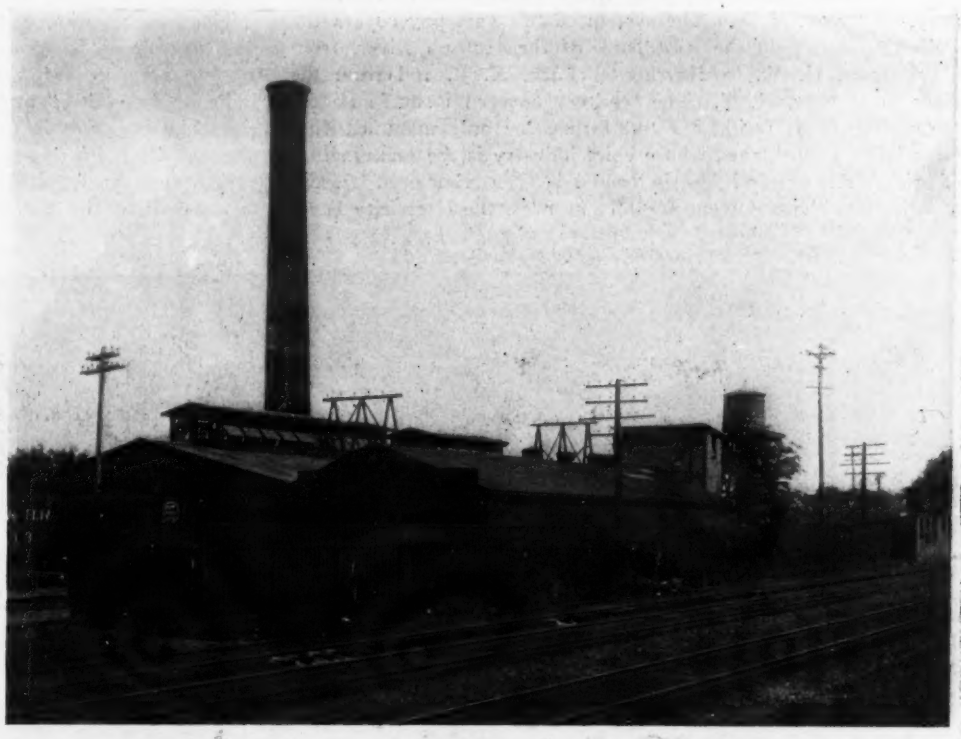


FIG. 3.—ORANGEBURG STATION, SHOWING COAL SIDING AND HIGH-TENSION TOWER AND LINES TO HAVERSTRAW.

through the wall of the engine room for the purpose of housing the belt drive from a small engine. This engine is also belted to a small centrifugal pump set in a pit below normal water level of the cooling tower well which supplies injection water to the condenser. This obviates the necessity of priming the pump when starting.

Exhaust steam from the auxiliaries is conducted to two heaters, one a primary and the other a secondary. Suitable valves in the exhaust lines provided complete control of the temperature of the feed water. When the engine exhaust is greater than necessary for heating the feed water, the excess steam is permitted to escape to atmosphere through a relief valve. A relief valve is also provided on each turbine in case of loss of vacuum. Since the installation of the second turbo-generator a Wheeler surface condenser has been installed between both the units as shown in Fig. 1. This is large enough for both units and the jet condenser has been placed in a pit for reserve use. By the installation of the surface condenser the economy of the turbine has been somewhat improved. With the old equipment it was not possible to maintain a very high vacuum, so that what with low vacuum and low steam pressure, the first turbine was operating at no little disadvantage. With the addition of a new boiler it is probable that the steam pressure will be increased so as to obtain the additional economy possible thereby.

Fig. 4 is a view of the switchboard. The outgoing circuits are regulated from this board through Stillwell regulators, one of which is placed on each phase of the two-phase circuits. By means of a chart consisting of a straight line curve, the ordinates of which represent voltage and the abscissas current, the switchboard attendant is enabled to tell at a glance what voltage is required to compensate for the drop in the circuit. The direct current from the motor-generator set is used by the Fibre Conduit Company, whose factory adjoins the electric light station. There are two sets of Scott-connected transformers which step up the 3,300-volt, two-phase current to 16,000-volt, three-phase current for transmission to Haverstraw. This transmission line runs parallel to the railroad track of the West Shore Railroad

over private right of way. Bare copper wire is used and the distance of transmission is over 12 miles. Fig. 5 shows a view of the old station at Haverstraw, now a sub-station. Here the 16,000-

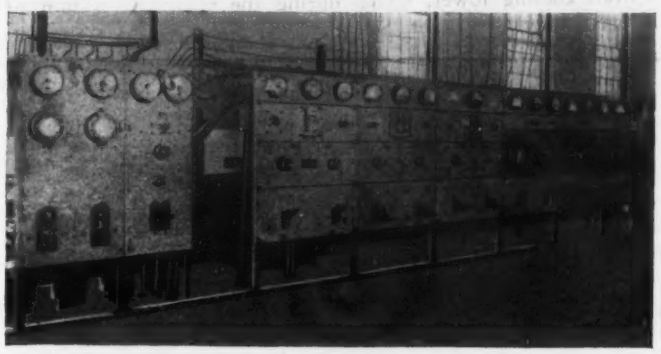


FIG. 4.—SWITCHBOARD, ROCKLAND LIGHT & POWER COMPANY.

volt, three-phase current is stepped down to two-phase and single-phase current for distribution in Haverstraw.

At Haverstraw the company finds its best paying business. Here the day load exceeds the night load and the company has secured practically all of the lighting business. The chief motor load is furnished by the brick yards with which the place abounds. It is only recently that electricity has been tried in the brick making business; and its progress is slow but sure. The brick makers make brick just as their forefathers made it and look askance at anything modern. They know nothing of electricity, much less of kilowatt-hours, and can only comprehend its advantages when told how much it will cost to make a thousand brick by its use. They know from long experience and use exactly how much it costs them to make brick per thousand by steam engine, and if the guaranteed cost of electricity is less they will consider it. The old method is to drive a shaft 300 or 400 ft. long by means of a steam engine and to belt the pug mills to this shaft. The expense of installing and lining up this exposed shafting is very great and of course the friction losses are also very great. Twenty-two thousand brick constitutes a day's work for a machine. The clay is dug from the banks and thrown into a pug mill which, in the parlance of the brick maker, tempers it. It then passes down to the mold where it emerges as formed brick ready to be dried.

There are two methods of drying brick; in the open yard or older system the bricks are placed in the sun to dry. The number of bricks that can be made by this method is, therefore, limited by the drying space. In these yards the pug mills operate only from 4 a.m. to 10 a.m., the rest of the day being taken up in arranging and drying the bricks and running them to the kiln so as to leave the space ready for the next day's work. In the pellet system the bricks are placed in racks arranged in parallel rows across the yard. With this system more than double the number of bricks are dried in a day, so that the pug mills operate until 4 o'clock in the afternoon. Each pug mill is driven by a 25-hp,

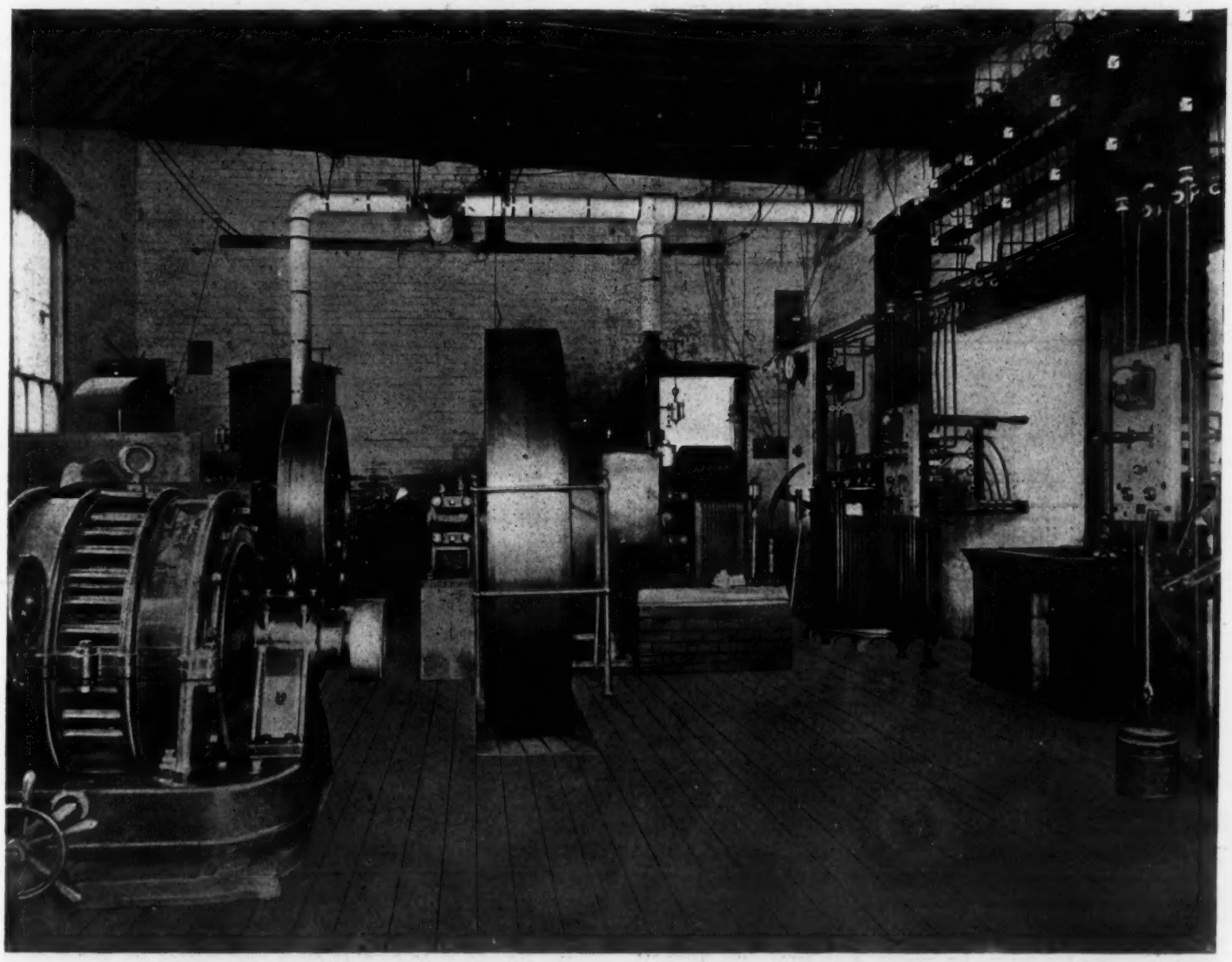


FIG. 5.—SUB-STATION AT HAVERSTRAW, SHOWING ALSO OLD GENERATING EQUIPMENT NO LONGER USED.

two-phase induction motor and the work on these is very severe, especially in starting up. The pug mill is left filled with clay when it is shut down for the day, and during the night this becomes quite hard and dry. The motor is started next morning with this load and the initial rush of current at starting is very great. Only a very small per cent of the brick yards in Haverstraw are operated by electricity, but from the data accumulated by the company it is shown that electrical operation is much

cheaper than steam, so that it is only a matter of time when nearly all of the yards will be thus equipped. The first yard to operate by electricity did so of necessity, a 30-hp motor load being connected. The operation of this was watched with no little interest, and so satisfactory were the results and cost that a motor load of 225-hp was soon connected in other yards.

A silk mill at Haverstraw will also be electrically operated shortly. This mill has 230 looms on each of which will be a ½-hp, three-phase motor. These motors are of special design and are fitted with ball bearings so as to reduce friction to a minimum. This was done for the purpose of enabling the rotors to keep turning all the while and thus reduce the current taken necessary when starting from standstill, it being necessary to start and stop the looms frequently. The regulation is thereby improved and the cost of energy reduced.

A new arc lamp system was installed at Haverstraw on July 1 of this year consisting of 26 enclosed arcs. The contract also calls for 116 additional series incandescent lamps and 59 incandescent lamps in West Haverstraw. These are run on an all-night basis, the company receiving $88 per year for the arc lamps and $19 per year for the incandescent lamps. The tub transformers for operating the arc lamps are shown in the engraving of the Haverstraw sub-station. The number of lamps connected to this station is 7,500 and the day motor load is 300 hp. The Haverstraw Light & Fuel Gas Company operate a gas plant in Haverstraw and charge $1.50 per thousand cubic feet of gas. The amount of opposition offered to the electric light company by the gas company may be gauged by the fact that the amount of gas manufactured by the gas company daily does not exceed 15,000 cubic feet. The gas company has such a strenuous time of it that its office is usually closed. Nernst lamps are used to fight gas wherever opposition crops up.

FIG. 6.—MOTOR-DRIVEN PUG MILLS IN "OPEN YARD" BRICK WORKS.

The company has contracts for public street lighting by means of series incandescent lamps in the Nyacks, Grand View, Piermont, Closter, Demarest and Nanuet, enclosed arc lamps also being used in Nyack. The incandescent lamps are fed from 3,000-volt circuits and the contract price for each is $19 per year. The company operates the gas plant in Nyack, the price of gas being $2 per thousand cubic feet. A discount of 25 per cent is allowed for payment within ten days. The rates for electricity are 20 cents, 10 and 5 with a cash discount of 10 per cent in 10 days. The rate for energy for motors is 10 cents with discounts varying from 20 per cent to 50 per cent, the price in some cases being as low as 3½ cents. The number of customers using electricity is 1,500 and the number of customers using gas is 700. The company has three auxiliary stations and offices, besides the main office at Nyack. The system is divided into districts, each of which has its district superintendent, corps of workers and equipment for repairs, etc. The district superintendent at Closter, N. J., takes care of the Jersey district, looks after complaints, reading of meters, repairs, etc., in that district. The superintendent of the western division is located at Spring Valley, N. Y., and the superintendent of the northern division is located at Haverstraw, N. Y. The main office at Nyack looks after matters in and around Nyack. All extensions are made through the Nyack office, which controls the erecting gang. The company has within the past few years made a great many extensions varying in length from ½ to 1 mile from the main lines. These are made on a running charge equal to the interest on the cost of running the extension, depreciation, etc.

For the first time in years the company is making a systematic test of all the meters connected to its system, thus forestalling any complaints along this line. In the greater part of the territory covered by the company the only choice for illumination rests between electricity, acetylene or kerosene oil. Gas is only procurable in Haverstraw and Nyack, and chief opposition has developed with acetylene plants. The company employs four solicitors, one of whom is well versed in acetylene lighting. Two of these are employed on a stated salary plus a bonus and two are employed on commission. The number of acetylene plants is fast decreasing as an explosion of one of these now and then usually results in a number of these plants being thrown out. The customers of the electric light company are wired for the most part with from 10 to 15 lamps, so that the revenue from individual customers is not very great. Up to January of this year there were only two electric signs in the whole territory covered by the company, one in Nyack and one in Haverstraw. The number of signs installed since then is over 50. These are installed free on a minimum rate of $3 per month. Where acetylene has been used for store lighting the company install three-glower Nernst lamps in opposition.

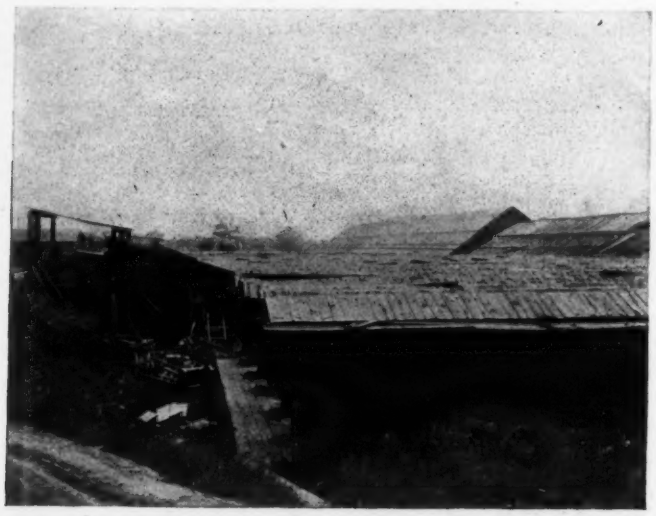


FIG. 7.—MOTOR-DRIVEN PUG MILLS IN BRICK YARD, PELLET SYSTEM.

Recently the company sent out a number of engraved invitations to a selected list of probable customers and to regular customers to witness a demonstration of electric cooking, heating, etc., in a large hall at Nyack, a band concert forming part of the entertainment. This resulted in a great many inquiries which were followed up to the advantage of the company. A demonstrator was also employed to introduce electrical heating devices in the homes of customers. In this way almost 200 flatirons have been distributed on trial, and a great many sold. The company is agent for the General Electric Company and carries a stock of motors on hand. These are sometimes sent out on trial, the company furnishing free electricity for a month, and the usual result is the sale of the motor and the acquisition of a new customer. No wiring or supplies other than motors and lamps are carried. Advertisements are inserted in seven papers and 1,000 copies of the New York Edison Bulletin are distributed monthly, "Compliments of the Rockland Light & Power Company" being printed in red across the top of the cover. As an evidence of the utility of the campaign started on the first of the year the records of the company show that the additional load in equivalent 16-cp lamps connected during the first six months of the year is as follows: January, 450; February, 650; March, 1,000; April, 1,300; May, 2,800, and June, 3,000. J. S. Kirkpatrick is the manager of the company.

The Lighting of Halls and Corridors of Large Buildings.

BY J. R. CRAVATH AND V. R. LANSINGH.

THE lighting of halls of large office buildings, hotels and public buildings is frequently one of the most difficult tasks met with in illumination work, for the reason that the artificial light must be used during the daytime when the halls are also partially lighted by daylight. The light from electric incandescent lamps, which must be used as a rule in such places, is likely to appear yellow and sickly by contrast with white daylight. The object to be attained in the lighting of long halls and corridors is to produce a general cheerful well-lighted effect. Here is a case where the lighting of the ceilings and side walls as well as that of the floor is important. Nevertheless, the color of the floor plays an important part in the general effect, and it is almost impossible to make a hall with a very dark floor appear well lighted. It is important to have the lights well distributed along the length of a long hall rather than to place large lamps or clusters at less frequent intervals. The reason for this is very simple. With chandeliers or clusters at infrequent intervals, the spaces midway between clusters appear poorly lighted by contrast with those portions of the hall near the clusters. The result is that this alteration of light and dark places makes the hall appear gloomy and poorly lighted even though the total candle-power of lamps may be sufficient. To light a long corridor well, therefore, it may be laid down as a first principle that small lighting units at frequent intervals should be employed. These units may be equipped in a variety of ways as explained later.

The next problem is to equip the lighting units so as to avoid the glare of a row of bare incandescent lamp filaments as one looks down the hall. This glare, in addition to being crude, cheap and inartistic in the evening, has the further objection that it looks sickly and ineffective when a hall is partially lighted by daylight. Enclosing globes of sand-blasted glass or lamps with frosted bulbs have the effect of making the electric incandescent light appear to much better advantage when there is a mixture of daylight, besides looking the more artistic at all times. Holophane globes, while they accomplish the purpose of diffusing and reducing the intensity of light and at the same time redirecting its rays, do not appear, when there is a mixture of daylight, to as good advantage as do either the sand-blasted or frosted globes.

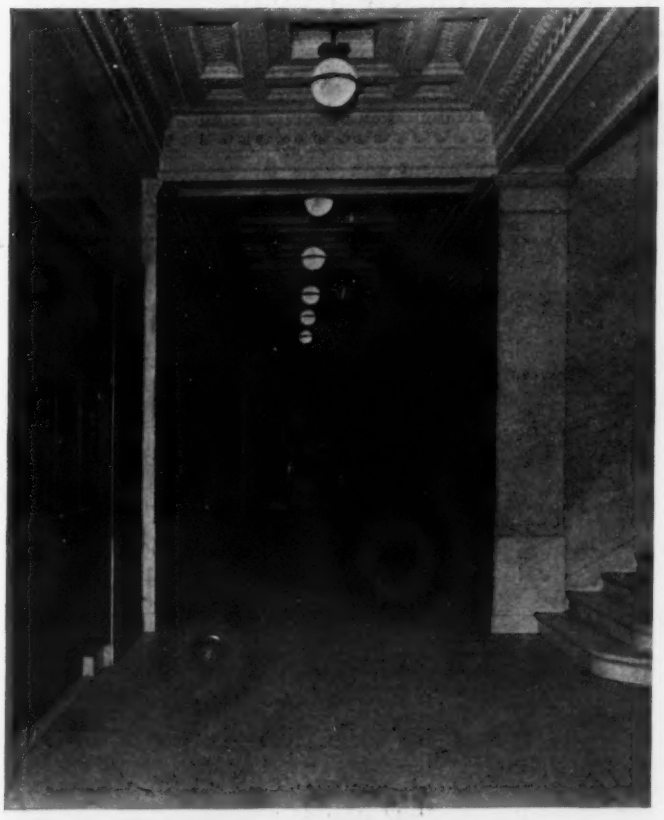


FIG. 1.—CORRIDOR, STATE MUTUAL BUILDING, BOSTON.

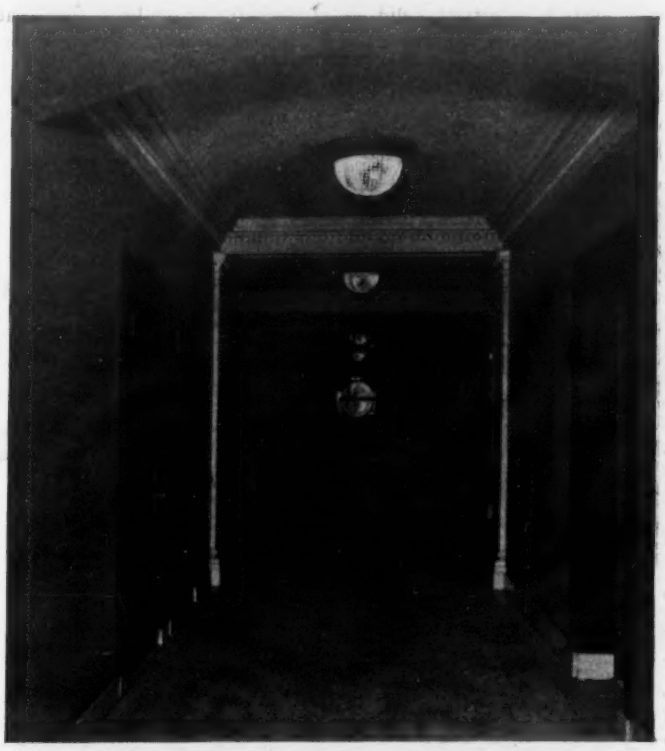


FIG. 2.—CORRIDOR, BOARD OF TRADE BUILDING, BOSTON.

In the lighting of hotel corridors, off which there are sleeping rooms, the problem is somewhat different from that in office and public buildings and corridors off the lobby of a hotel, because the upper part of the corridor must be kept dark to prevent light shining through the transoms and annoying guests who have retired for the night and wish an absolutely dark room.

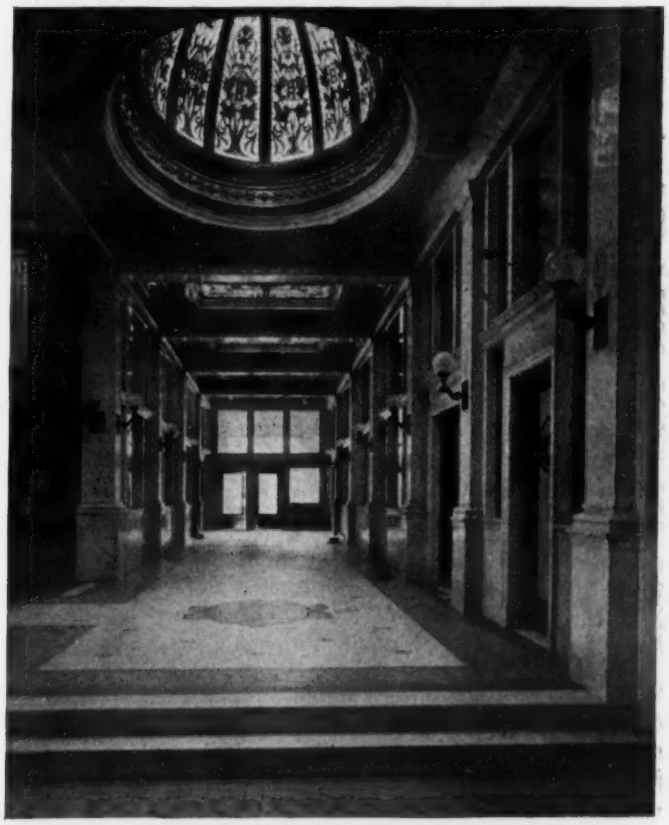


FIG. 3.—MAIN FLOOR, HELLMAN BUILDING, LOS ANGELES.

Fig. 1 shows a corridor in the State Mutual Building, Boston,

in which correct principles are carried out in the location of lighting pendants at frequent intervals down the length of the hall. These pendants are in this case equipped with Holophane spheres which are more permissible in a dark hall of this kind than in one where there is a considerable mixture of daylight for the reasons before mentioned. One lamp with a nearly flat prismatic reflector is the best equipment for use inside of spheres in such a location. In a hall where there is much daylight an arrangement

FIG. 4.—CORRIDOR SOMERSET HOTEL, BOSTON.

like that in Fig. 1 might be employed with the substitution of ground glass spheres in place of the Holophane spheres and the use of a flat prismatic reflector over the lamp inside each sphere. With an arrangement such as shown in Fig. 1 it is possible, although of questionable utility (as later explained), to equip each sphere with two lamps on separate switches, so that either one or two lamps can be turned on as may be required, thus giving two different intensities of illumination in the hall. If two intensities are desired, this is a much better arrangement than that of turning off the lamp on every other pendant, as is sometimes done. The effect of turning off every other lamp is to produce light and dark areas down the length of the hall, making it appear gloomy as well as spoiling the appearance of the row of lamps.

Another way of providing for lamps on separate switches at each outlet in corridor lighting is to install hemispheres as shown in Fig. 2.

As to whether two intensities of light are practically needed in the ordinary office building, there is room for argument, and it is to be seriously doubted whether such provision is necessary. Enough lamps must be provided to light the halls well during the hours of darkness. What would be a very good intensity of light in a hall in the hours of darkness would seem rather gloomy during the hours when certain portions of the hall are lighted with daylight. It will, therefore, usually be necessary if any artificial light is employed during the daytime, to use as much then as is needed at night, in order thus to avoid a gloomy appearance in the hall.

There is also room for some argument as to whether reflectors inside the globes are necessary or advisable where a row of pendants is located as in Fig. 1. It may be held that since the object of hall lighting is to make the whole appear cheerful, it is as necessary to light the ceilings and high side walls as the floors. It must be remembered, however, that the lamps themselves are located very near the ceiling and high side walls, while they are some distance from the floor; and that if no attempt is made to alter the natural distribution of light, the ceilings and high side walls will receive much more light than the floors, with the result that the floors may appear rather dark and spoil the whole effect. For this reason reflectors inside the globes are usually advisable in the ordinary office building hall, such as shown in Figs. 1 and 2, since by their use a fairly even illumination of ceilings, walls and floor can be secured. In case enclosing globes with 4-in. holders or larger are used, small reflectors which slip directly on the lamp bulb can be secured which add to the downward illumination very much. Some such reflectors are of the prismatic type and others are of metal with either bright metal or white enamel reflecting surface. A very small opaque reflector is permissible inside of a ground glass diffusing globe for the reason that the diffusion in the globe with a small reflector will disguise the fact that the reflector is opaque, and the ceiling above will not be seriously darkened.

There are certain classes of public building halls which are more in the nature of lobbies where it is sometimes desirable to throw light upward to illuminate architectural or artistic features of high vaulted ceilings. Such cases will be taken up under the head of lighting of lobbies.

A case somewhat of this character is presented in Fig. 3, which is a corridor on the first floor of the H. W. Hellman Building, Los Angeles. Here the lighting is by means of lamps enclosed in sand-blasted globes placed on high brackets along the side walls in a position where they illuminate floors and ceilings about equally. In a hall of this kind which has white marble finish and light floors, it is easy to produce a cheerful appearance and no special attempts to direct the rays of light are necessary with side brackets located as shown.

Another example of this is the corridor in the Hotel Somerset, Boston, Fig. 4. Here the lighting from the brackets is supplemented by lamps located in a cove above the cornice and throwing their light to the ceiling. This indirect lighting, although pleasing, is an expensive method of producing results for the reasons mentioned by the authors in an article on the "Lighting of Large Public Rooms," in the issue of a month ago.

An Economical Method of Constructing Induction Coils.

By W. F. Lent and L. B. Weeks.

THE induction coil is indispensable to the experimenter in wireless telegraphy, radiography, high-frequency work and in fact all work for which a high tension current is needed. On account of the high prices usually charged for coils or for the materials generally used in making them, many are unable to obtain this most useful apparatus. It is the purpose of this article to describe a method of building coils which requires far cheaper materials, takes much less time to construct and yet produces a coil distinctly better than the average. The total cost of making a 6-in. coil to be used with an electrolytic interrupter, that is, without condenser and mechanical break, is somewhat under twenty dollars. If the builder

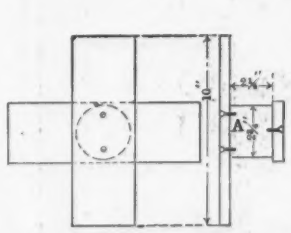


FIG. 1.—THE FORM.

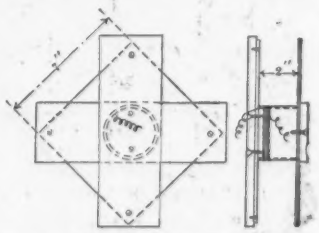


FIG. 2.—FORM WITH SECTION IN PLACE AND READY TO WIND.

does not care for exterior finish, the cost would be considerably less.

The only expensive tool used in the method is a lathe which can cut sixty threads, both right and left hand, to the inch, and which swings, or can be made to swing, by blocking up the head and tail stocks, 10 in. over the carriage. If such a lathe is not at hand, a substitute can readily be rigged up with the expenditure of a dollar or two and a little ingenuity.

As the exact dimensions of the rest of the coil are dependent upon those of the secondary, the construction of the secondary

will be taken up first. For this the following material will be needed:

12 pieces ⅛-in. sheet fibre, 7x7 in.
12 strips medium unglazed paper (0.018 in. thick, 2¼x22 in.).
600 strips thin unglazed paper (0.0045 in. thick, 2x24 in.).
6 lbs. bare No. 36 B. & S. copper wire on a spool.
6 ft. 3/16 in. round fibre rod.
1 ft. ⅝-in. round fibre rod.
100 ft. bare No. 25 B. & S. copper wire.
20 lbs. best white paraffine.
A form constructed of pine according to Fig. 1.
Thick shellac varnish.
Other materials as mentioned below.

Wind two strips of the medium paper on the mandrel of the form, fastening down the second with thick shellac varnish.

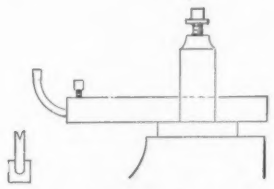


FIG. 3.—GUIDE FOR WIRE.

Cut holes in the center of two of the 7-in. fibre squares so that they will fit over the paper as tightly as possible; put on the form heads and screw a fibre square to each of them. Drill a hole diagonally through the paper next the core; slip through a foot of cable, made of half a dozen strands of bare No. 25 wire; take one turn of it around the paper on the mandrel; splice the No. 36 wire to the cable and the section is ready to wind. (See Fig. 2 for the relative positions of parts.) The spool of wire should be supported so as to unwind easily. From the spool the wire goes under a rod to increase and steady the tension, then over the V-shaped guide (constructed according to Fig. 3) in the tool post of the lathe and finally is wound on the section which is chucked in the lathe—the gears being set for cutting 60 threads to the inch.

When the lathe is started, the wire will wind evenly upon the mandrel and each turn will be one-sixtieth of an inch from the one next to it. Begin winding one-fourth of an inch from the inside of one head and wind to the same distance from the other head. Reverse the direction of the carriage; slip the end of a piece of thin two-inch paper, long enough to make one layer with a lap of about one inch, under the wire; wind back over the first layer of wire, letting the paper wind on with the wire. Reverse the carriage again, slip in paper between layers and continue winding in this manner until 130 layers of wire have been put on.

This will make a diameter of about 5¾ in. Finish the section by attaching a piece of cable and bringing the wire out by drilling through the coil head (see Fig. 4 for relative positions of ends). Put a layer of paper and one of thread spaced by the winder, over all. Take the section from the form and run

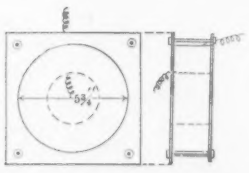


FIG. 4.—COMPLETE SECTION.

a bolt with nuts made of the fibre rods through each corner (as in Fig. 4). Bake for half an hour at a temperature of 120°-130° C.; immerse immediately in melted paraffine until all air bubbles cease to rise, the paraffine being kept at a temperature not exceeding 120° C. When the bubbling ceases, let the paraffine cool down until it is nearly hard; take the section out and brush off the superfluous wax.

Build six sections in this manner, winding in the same direction and bringing the ends out in the same way. Test each for continuity of the wire. When the six sections are complete and after they have been saturated with the melted paraffine, place them in a box (7 in. inside breadth, other dimensions according to Fig. 5) in the positions shown in Fig. 5. Arrange the sections so that the holes will be concentric with the fibre tube shown in the figure. Connect the terminal wires of the sections as shown in Fig. 5 and test the whole series for continuity with a high resistance voltmeter. If there is no break, continue with the construction.

Place the fibre tube, shown in Fig. 5, in position in the box and make the bottom and sides air-tight with putty. Melt about fifteen pounds of paraffine, being careful not to let the temperature exceed 120° C. (248° F.), and fill the box from the top, pouring in more paraffine as contraction takes place. Attach the secondary terminals to the rods leading through the hard rubber posts to the binding screws (shown in Fig. 5); screw down the lid and the secondary is complete.

The core is made by packing a fibre tube, 17 in. long by 1 in. inside diameter with one-sixteenth inch walls, full of No. 18 B. W. G. iron wire, *specially* annealed for coil cores. The ordinary annealed iron wire is not suitable. The core is wound with two layers of No. 12 B. S. single silk-covered copper wires to about one-half inch from each end. The space allowed for the primary is so closely calculated that it is necessary to wind the layers separately and in the same direction. This method also has the advantage of allowing either series or parallel connection of the layers. When the primary is completed, soak it for fifteen minutes in hot paraffine; let the wax cool until it is nearly hard; then, remove and scrape off the

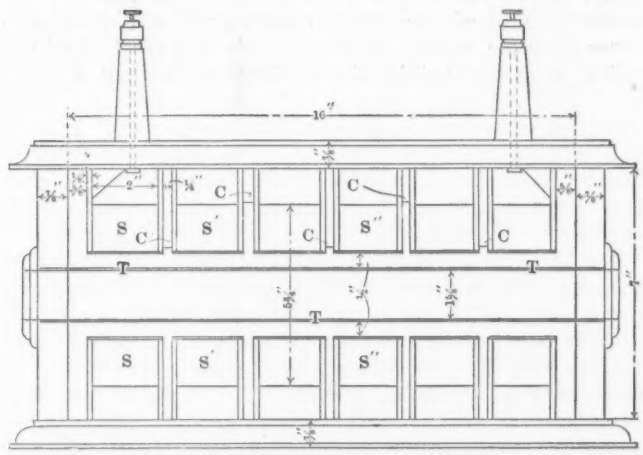


FIG. 5.—PLAN OF COMPLETE COIL.

superfluous wax. Slip the primary into place in the tube of the secondary, connect its terminals to binding posts and the coil is ready for use.

The principal advantages offered by the method of construction above described, are as follows:

(1) The use of paraffine as an insulator between the primary and secondary coils (suggested by an article appearing in "Electrical Designs," entitled "The Construction of an Induction Coil," by Geo. T. Hanchett), which was found to be a very satisfactory plan of insulation, though by no means essential to the successful building of a coil with bare wire.

(2) The substitution of bare for insulated wire, which reduces the cost—insulated wire being about five times more costly than bare—saves time in the coil building, and is much more convenient in that it can be handled with much less care.

We have tested a coil, constructed according to the above method, on a Wehnelt electrolytic interrupter run on a 110-volt lighting circuit up to 25 amperes with no unsatisfactory results other than the partial melting of the wax in the primary. The longest sparking distance tried was 7 in., though, judging from the thickness of the spark, the distance might have been considerably greater without the least damage to the insulation of the secondary. We hope that others may have as much satisfaction from the use of a coil built according to this description as we have had.

Photometry.*

By Prof. W. S. Franklin and Prof. William Esty.

RADIANT HEAT—LIGHT.

THE radiation from a hot body may be resolved into simple parts, each of which is a train of ether waves of definite wave length. All of these simple parts of the total radiation have one common property, namely, they generate heat in a body which absorbs them. Therefore, every portion of the radiation from a hot body is properly called radiant heat. The intensity of a beam of radiant heat is measured by the heat it delivers per second to an absorbing body. Thus the radiation emitted by a standard candle represents a flow of about 450 ergs per second across one square centimeter of area at a distance of one meter from the candle. (Heat is properly expressed in energy units. One erg of heat is the amount of heat that is equivalent to one erg of mechanical energy.)

Radiant heat of which the wave length lies between 39 and 75 millionths of a centimeter affects the optic nerves and gives rise to sensations of light. These limits, which are called the limits of the visible spectrum, are not sharply defined, but they vary considerably with different persons and with the degree of fatigue of the optic nerves.

The physical intensity of a beam of light is measured by the heat it delivers per second to an absorbing body. Thus those parts of the radiation of a standard candle which lie within the visible spectrum represent a flow of about 9.3 ergs per second across an area of one square centimeter at a distance of one meter from the candle. Comparing this with the flow of energy which is represented by the total radiation from a standard candle, namely, 450 ergs per second across an area of one square centimeter at a distance of one meter from the candle, it follows that only about 2 per cent of the energy radiated by a standard candle lies within the limits of the visible spectrum; that is, only about 2 per cent of the radiation from a standard candle is light.

The luminous intensity of a beam of light is presumably measured by the intensity of the light sensation it can produce, but the intensity of the light sensation produced by a given beam of light is extremely indefinite. A given beam of light entering the eye may produce a strong or a weak sensation, depending upon manifold individual peculiarities of the person, and upon the degree of fatigue of the retina; and the vividness of the sensation depends upon the extent to which it is enhanced by attention. Our sensations are really not quantitative in the physical meaning of that term. In fact they enable us merely to distinguish objects, to judge whether things are alike or unlike, and the certainty and precision with which we can do this is exemplified in every outward aspect of our daily life. The ratio of the luminous intensities of two beams of light is measured by using a device to alter in a known ratio the physical intensity of one beam until it gives, as nearly as one can judge, a degree of illumination on a screen which is equal to the illumination produced by the other beam.

PHOTOMETRY.

The measurement of the light emitted by a lamp is always made by comparing a beam of light from the given lamp with a beam of light from a standard lamp. The comparison of the total light in a beam from a given lamp with the total light in a beam from a standard lamp is called simple photometry; whereas the comparison wave length by wave length is called spectro-photometry.

A fundamental difficulty in simple photometry is that different lamps usually show differences of color, and these differences of color do not disappear when the attempt is made to adjust a photometer to equality of brightness.

The results of the spectro-photometric comparison of gas light, lime light and day light are shown by the curves in Fig. 1. The curves refer to beams of gas light, lime light and day light, all of which have the same intensity at Fraunhofer's *D* line (the middle of the yellow region of the spectrum); and the curves show, for example, that the beam of day light is about six times as bright as the beam of gas light at Fraunhofer's *F* line (in the blue region of the spectrum), and only about one-fourth as bright as the gas light at Fraunhofer's *B* line (in the red region of the spectrum).

*Condensation of a portion of a chapter of Franklin and Esty's "Elements of Electrical Engineering," now in press.

STANDARD LAMPS.

The British standard candle is a sperm candle made according to exact specifications and burning 120 grains of sperm per hour. The Hefner lamp, so called from its inventor, is a lamp which burns pure amyl acetate. The wick and its containing

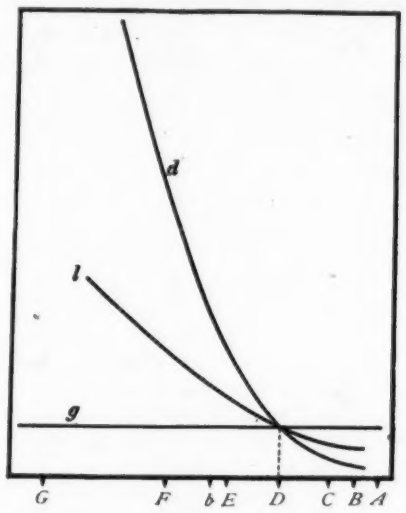


FIG. 1.—COMPARISON OF LIGHTS.

tube are of prescribed dimensions and the wick is turned up to give a flame of prescribed height.

The intensity of a horizontal beam of light from a Hefner lamp is called a hefner unit or a hefner. If a lamp were to give one hefner unit of light intensity in every direction, the amount of light, or the so-called flux of light emitted by the lamp, would be what is called one spherical hefner.

The great reliability of the Hefner lamp as compared with the standard sperm candle has led to the definition of the candle in terms of the hefner unit. The candle or the candle unit is a beam of light of which the intensity is 1.136 hefner units and the spherical candle is equal to 1.136 spherical hefners. The standard sperm candle is no longer used in photometric work.

CONICAL INTENSITY AND SECTIONAL INTENSITY OF LIGHT.

The expression, intensity of a beam of light, which is used in the above definitions of the hefner and the candle, refers to the amount of light in a unit sized cone of rays. This *conical intensity*, which it may be called for brevity, is expressed in hefners or candles; it is independent of distance, since the light in a given cone of rays remains in that cone; and it depends only upon the area and brightness of the luminous surface of the lamp. The intensity of a beam of light may also refer to the amount of light per unit sectional area of the beam. This *sectional intensity* of a beam of light, which it may be called for brevity, decreases as the square of the distance from the lamp increases, and it is expressed in terms of a unit called the *lux*, which is the sectional intensity of a horizontal beam from a Hefner lamp at a distance of one meter from the lamp. The sectional intensity, *I*, of a beam in luxes at a distance of *d* meters from a lamp is given by the equation:

$$I = \frac{h}{d^2}, \qquad (1)$$

in which *h* is the conical intensity of the beam in hefner units.

The amount of light per unit sectional area of a beam, that is, the sectional intensity of the beam, measures the intensity of illumination of a surface upon which the beam falls perpendicularly. Therefore, the intensity of illumination of a surface may be expressed in luxes. Thus the intensity of illumination required for easy reading is the intensity of illumination at a dis-

tance of one foot from a standard candle, which intensity is sometimes called the "candle-foot," and it is equal to $\frac{1.136}{(0.305)^2} =$ 12.21 luxes, according to equation (1).

The Bunsen photometer is a device for measuring the conical intensity of a beam of light from a given lamp in hefners or in candles. It is the photometer that is almost universally used in simple photometric measurements. The given lamp and the standard lamp are placed at the ends of a horizontal bar and a screen of thin unsized paper is moved along the bar until the two sides of the screen are equally illuminated by the two lamps. The intensities of illumination (sectional intensities of the beams of light) due to the respective lamps are h/d^2 and h'/d'^2, according to equation (1); and since these are equal we have:

$$\frac{h}{h'} = \frac{d^2}{d'^2}, \qquad (2)$$

in which h and h' are the conical intensities in hefners or in candles of the light sent towards the screen by the respective lamps, and d and d' are the distances of the lamps from the screen.

DISTRIBUTION OF LIGHT AROUND A LAMP.

In the definition of the spherical hefner the idea of uniformity of distribution of light around the lamp was introduced for the sake of simplicity. In fact, however, no lamp gives complete uniformity of distribution, but the conical intensity in hefners or candles is always greater in certain directions and less in other directions.

The distribution of light about a lamp, which, like a carbon filament electric lamp, can be held in any position, may be determined by mounting the lamp on a universal holder at one end of the photometer bar, turning it step by step into various positions and taking the photometer reading for each position.

In some cases a lamp is symmetrical with respect to an axis, so that a complete knowledge of the distribution of light about the lamp may be obtained by determining the intensities of the light in different directions in a single plane which contains the axis of symmetry.

In many cases a lamp is approximately symmetrical with respect to an axis so that the slight variations of the intensity of the light around the axis of approximate symmetry are of no consequence. In such a case the lack of symmetry may be averaged out, as it were, by rotating the lamp at a speed of three or four revolutions per second about its axis of approximate symmetry while the photometer readings are being taken.

MEASUREMENT OF TOTAL LIGHT FLUX FROM A LAMP.

If a lamp were to emit light of the same conical intensity in every direction, then the conical intensity of the light in hefners (or candles) would be numerically equal to the total light flux from the lamp in spherical hefners (or spherical candles), and a single measurement of the light from such a lamp by means of a Bunsen photometer would give not only the conical intensity of the light in hefners (or candles) but also the total light flux in spherical hefners (or spherical candles).

In general, however, light is emitted by a lamp unequally in different directions, and it is necessary to distinguish between conical intensity and total light flux. The total light flux in spherical hefners emitted by a lamp is determined by measuring the conical intensity in hefners in every direction and taking the average, which gives the light flux in spherical hefners. If this average is to be calculated in the ordinary way by adding and dividing, the directions in which the separate readings are taken must be distributed uniformly over the surface of a sphere with its center at the lamp. This sphere is called the reference sphere for brevity. If the readings are not so distributed, each reading must be multiplied by the spherical area that may be properly assigned to it, and the sum of such products must be divided by the total area of the reference sphere to give the correct average. When a lamp can be rotated at a speed or from three to four revolutions per second about its axis of approximate symmetry, the total light flux may be determined accurately by taking readings of the conical intensity in different directions in one plane only, namely, a plane which includes the axis of rotation.

An ingenious arrangement of mirrors has been devised by Prof. C. P. Matthews by means of which the total light flux from a lamp can be measured by a single setting of a photometer. This arrangement is called an integrating photometer and it is destined to come into general use. The great advantage of the integrating photometer is that it makes the measurement of light flux in spherical candles feasible in practical work and thereby makes possible the basing of the commercial ratings of lamps on spherical candle-power, a thing greatly to be desired.

Electrochemical Processes as Central Station Load Equalizers.

At the recent Ithaca annual convention of the American Electrochemical Society, Mr. Elmer A. Sperry, well known in electrical engineering circles, read a paper pointing out how electrochemical processes may be applied to flatten out the central station load curve, which is reprinted below:

For some years the station manager, the electrochemist and the electrometallurgist have been groping for each other. For some reason there is a notable lack of any union of interests of any electrochemical process deriving its supply or utilizing equipment of the central station. Papers have been read and much said as to the possibilities of this combination, which, however, does not seem to materialize.

Some time ago the author undertook some investigations as to the exact conditions existing with some central station managers and what terms they were willing to make as inducement to the establishment of permanent electrochemical loads of more or less magnitude. One prime requisite with electrochemical processes is cheap and centrally located power; and many of these processes may easily become large consumers of power.

The question naturally arises, why is it that this combination has not been brought about, as earlier expected. The result of observations and of such time as the author has been able to devote to the question has been that neither party has, as yet, by any means exhausted this subject, and, furthermore, that some misunderstanding exists as to the conditions which are capable of being so harmonized as to yield commercial results to both.

The condition is growing more favorable in that the central station manager is constantly gaining knowledge and experience as to the value and relation of certain factors in this load curve, and something as to what it means to him to have the valleys filled, portions of his load equalized, and the mean load increased. We hear much about the evils of the peak in the station load curve; the peak in the load curve is only a relative matter, and there are managers who still think that the disadvantages of peak load is a matter of altitude of the peak. Not at all so; on the contrary, it is only a matter of prominence above surroundings, and its evil is in its height in relation to mean load. The peak represents the investment, while mean load represents receipts. Anything that brings up the latter, contributes directly to earning capacity, and (a point which is not generally recognized in this connection) almost wholly independent of the rate received for the additions if they are rightly placed on the load curve.

Another favorable sign is that managers are becoming more and more keen for business, and as their stations increase in importance, are able to make concessions and inducements for loads impossible a few years ago, and, in many instances, are willing to make very low rates for "off-peak" load. The operations of the stations vary through quite wide limits as to the hours and seasons which they can furnish current falling strictly within this class. With the very closest prices that have been named, the station manager has, in some instances, demanded the emergency privilege of cutting off the current always with notice, unless absolutely impossible, and, in one or two instances, the price has been made on a sliding scale, based on the price of fuel. In connection with this last item any long-time contract should include considerations relative to the conversion factors

or the thermal efficiency of the prime movers employed in such a way as to properly cover the actual fuel factor, as represented in the power cost, in the mutual interest of parties concerned.

The hours and seasons available in various stations fall within three classes, the most favorable being a guarantee of twenty-four-hour power for ten months of the year, approximately, or forty-three weeks; three weeks, twenty-two-hour power, and six weeks, twenty-hour power, during these two latter periods guaranteeing forty hours' continuous power at the weeks' ends. This gives full year, less 180 hours, or about 98 per cent available time throughout the year. The second class grants twenty-four hours during about nine months of the year, or thirty-nine weeks; six weeks with twenty-one-hour power, and seven weeks with nineteen-hour power, guaranteeing during these two latter periods thirty-eight-hour continuous power at the weeks' ends. This class yields 96½ per cent of all available time. A third class demands a two-hour peak for six days each week, during which no power is furnished for ten months, or forty-three weeks of the year, and a four-hour peak during the remaining nine weeks. This class is willing to guarantee throughout the year forty-hour continuous power at the weeks' ends, which yields 92.6 per cent of the total time available.

Some station managers, especially those of the first class, go so far as to say that if they assume the load they will, in all probability, carry it more hours than guaranteed. Others, again, go so far as to intimate that they will find some way in which to carry it all the time, especially days when their battery is not unduly drawn upon. In every instance the cost will go higher if the energy is required to be transmitted to a distance, and the site for the electrolytic plant should be chosen accordingly.

It may be stated as a general proposition under these conditions, where the electrolytic load is available to equalize the station load, that power is available for electrolytic work in large units at equal rates, if not more favorable than those ruling for water power. Where the process is one that does admit of interruption, storage is, of course, always available, where the extra cost entailed permits its use. There are conditions under which the additional power cost entailed need not be great, and from the standpoint of the central station manager a storage battery is a most desirable adjunct. This arises from the fact that while its discharge is confined to short and definitely placid periods, its charge may go forward at periods entirely conformable to the demands of the station for equalizing purposes, while its economical rate of charge may be varied through exceedingly wide limits; therefore, available for the most economical loading of the generating units.

In some electrolytic processes the current may be dropped to a mere fraction of normal intensity, and, in this way, a comparatively small storage battery may be employed to carry the process over the cut-off periods.

Intermittent processes, or those susceptible of interruption under commercial conditions, are desirable in this connection. The electrolytic and electrothermic arts by no means abound in processes that may be considered commercially intermittent. It is expected that this condition will gradually change as the advantages of centrally-located, abundant and cheap power are brought more into prominence; this is evidently the duty of the station management having problems of load and equalization before it. On the other hand, the electrochemist and metallurgist should be none the less active. In fact, it would seem that his task is the greater. Processes that are applicable must be brought out, thoroughly tested, under conditions of service proposed, and demonstrated to be thoroughly practicable and commercial.

Electric Lighting of the Kokomo Traction System.

No great effort was made by the Kokomo, Marion & Western Traction Company, of Kokomo, Ind., toward the introduction of electric energy for use in the home, until the beginning of this year. Since that time, however, this company has been experimenting and as a result has undertaken a systematic campaign for extending and augmenting the general lighting and power business and particularly toward building up the day load. The results attained have been so encouraging that the company has already placed orders for additional electrical and power equipment, which has become necessary to take care of the new business. At the present time the company handles at one station the electric lighting load of Kokomo and Swayzee and also operates the street railway system of Kokomo and the interurban railway between Kokomo and Marion.

The new equipment now on order consists of a 1,000-kw Allis-Chalmers turbo-generator unit, wound for 60 cycles, 2,300 volts, three-phase, which corresponds with the current generated at present in the company's plant for distribution in Kokomo. For transmission to the sub-station at Swayzee, however, 10,000 volts are used. It is there stepped down and supplied to the interurban railway and for lighting at 208 volts on the three-wire system. Other electrical machinery, consisting of a 30-kw, direct-connected engine type exciter set, and a 35-kw motor-generator set together with switchboard, condenser and piping, will also be furnished by the Allis-Chalmers Company, whose engineers have full charge of erecting the new unit.

Kokomo has a population of 16,000 people; 800 consumers are now connected to the company's circuits; a year ago there were 485. The company has at the present time 14,000 incandescent lamps in operation, while a year ago there were scarcely 8,000. A commercial power load of 400 hp is carried now, whereas a year ago the motor load was 40 hp.

All along the line, between the Swayzee sub-station and the Kokomo power house, where the demand is sufficient to justify it, a transformer has been installed and the current stepped down to the voltage suitable for lighting and power purposes.

Electric Lighting System at Jenkintown, Pa.

Just before reaching Philadelphia over the Philadelphia & Reading Railroad from New York, the train passes through the picturesque towns of Wyncote and Jenkintown. Too near Philadelphia to be of any commercial importance, and just far enough away to attract the better class of society, these towns abound with the beautiful dwellings of many of Philadelphia's most prosperous merchants. Electricity is the principal illuminant in nearly all of these dwellings, gas being used chiefly for fuel.

The Jenkintown Light Company supplies the electricity to these towns and also to Glenside, Ogontz, Hatboro and Bethayres. The population served is in round numbers about 10,000 and the maximum load about 250 kw. The power house adjoins the railroad tracks a short distance to the north of the railroad station. The equipment consists of four Keeler boilers, Wetherill and Russell engines and three Stanley two-phase, 60-cycle, 2,300-volt inductor alternators. The latter are belt-driven and have an aggregate capacity of 460 kw. There is in addition a motor-driven exciter set the output from which is used for charging automobiles and also for exciting the alternators in case of mishap to the small belt-driven exciters with which each alternator is supplied. The plant is run condensing, a Deane jet condenser being used. Water for boiler feed is obtained from an artesian well, and water for condenser purposes is taken from a creek on one side of the station.

The circuits are all overhead, commercial lighting being supplied from pole transformers which step down the voltage from 2,300 to 110-220. There are about 40 motors in use, the largest being 35 hp. Motors up to 5 hp are fed with single-phase current, and all motors larger than 5 hp are fed with two-phase current. There are no special power circuits in use, all motors being fed from the lighting circuits. Where the motor load comes on at the time of the lighting load, separate transformers are installed for feeding the motors. There are very few places, however, where this is done, as most of the motors are used for pumping water in residences and hothouses. The large motors are used for pumping water for the railroad company. The motors are connected to triplex pumps which feed three large water tanks near the power house for locomotive use. Two of

these tanks have indicators visible from the power house, and the third is equipped with a high and low-water alarm, which rings a bell in the engine room of the power house when either condition obtains.

Six two-phase circuits run from the power house to supply the towns previously mentioned. The number of customers connected is over 700 and all but 30 of these are supplied by meter. The 30 supplied on flat rate will also be connected to meters as soon as their contracts expire. The equivalent load in 16-cp lamps is 24,000. The rate for electricity is 15 cents per kw-hour and in large installations where the Wright demand system of charging is in vogue, the rate for the first two hours is 15 cents; the rate for the third hour is 10 cents, and the rate for the fourth and subsequent hours of burning is 7½ cents. The streets are partly lighted by series incandescent lamps and partly by gas with Welsbach mantles. The electric light company has a contract for supplying 125 16-cp incandescent lamps and 145 25-cp lamps at a yearly rate of $15 and $20, respectively; there are no arc lamps in the entire territory fed by the company. The Jenkintown & Cheltenham Gas Company which supplies gas for some of the street lighting receives $24 to $29 per single Welsbach burner per year, the lower rate being on a five-year contract. Gas is sold by this company at $1.35 per thousand cubic feet, which is subject to a discount making the price $1.25 net. While nearly all of the houses are piped for gas, this is used chiefly for cooking purposes.

The Jenkintown Light Company employs no solicitors nor does it distribute any advertising matter whatever, yet for all that it is increasing its output 20 per cent each year and almost all the residences and what few stores there are in the district are connected to its system. Any soliciting that can be done is done through the employes of the company, and it is a very easy matter in a district such as that supplied by the company for the manager to watch all new work and keep in touch with it. The company carries supplies, does repair work and looks after the installation of special fixtures. In fact anything that a customer requests to be done is looked after by the company. The wiring of new buildings, however, is left to local contractors. The company has 50 miles of pole line and is at present making no extensions, choosing rather to load up the lines already in existence.

The office of the company is within a stone's throw of the railroad station and next to the post office. In the windows are displayed all sorts of heating devices, fans, etc., while on a board in the office are displayed a complete line of fixtures, shades, lamps, receptacles, sockets, etc. Owing to the character of the population there are quite a number of heating devices such as chafing dishes, curling irons, stoves, plate warmers and especially flatirons in daily use. Food warmers and electric fan motors are also used to a very large extent. These are supplied to customers at cost. In introducing the electric flatiron the company sent them out on a month's trial, after which they were disposed of to those who desired them at cost. There are many hundred of these irons in use on the company's circuits.

During 1905 the total energy output was 720,000 kw-hours. Of this about 33⅓ per cent was lost in distribution and transformers. Coal costs delivered over a spur track to the station on an average of $2.90 per ton. There are no refinements in the operation of the plant; in fact, one-half of the Wetherill engine is not in use, yet the station is worked as economically as possible. A Tirrill regulator is used to regulate the voltage and a maximum demand indicator is used to determine the size of transformer necessary on the lines. At present the smallest transformer for light circuits has a capacity of 2 kw and the largest has a capacity of 15 kw. The day load averages about 100 kw. The income last year amounted to $41,000 and the operating expenses, including depreciation, etc., were $30,000. The authorized capital of the company is $200,000, of which $100,000 is paid in. Bonds to the extent of $50,000 have also been issued. The officers of the company are as follows: E. C. Clay, president; B. Borie, Jr., vice-president; H. M. Blake, secretary and manager.

A Modern Suburban Light and Power Plant.

The Quincy Electric Light & Power Company, of Quincy, Mass., operates one of the most modern power plants in the Boston suburban territory. The plant is a thoroughly representative reciprocating engine installation and has recently been increased in capacity by nearly 178 per cent. About four years ago the plant was first placed in service; its capacity was 450 kw in generating machinery, and space was left for the addition of 800 kw more without enlarging the building. The growth of the

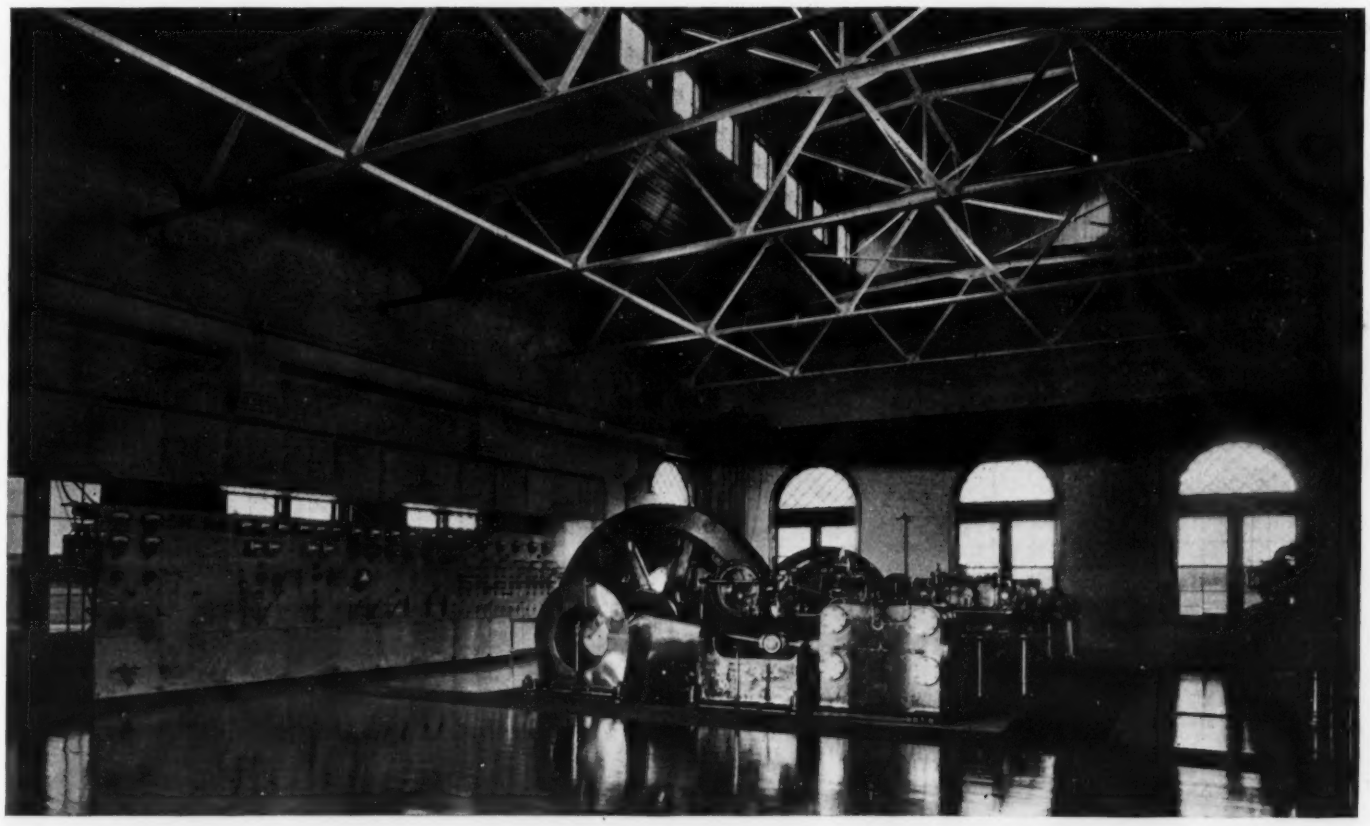


FIG. 1.—VIEW OF ENGINE ROOM, QUINCY ELECTRIC LIGHT & POWER COMPANY.

company's business required enlarged power facilities, and the plant stands completed to-day as an interesting example of a purely alternating, uni-voltage station.

The plant is located on tidewater about three-fourths of a mile north of the center of the city of Quincy, and it enjoys first-class condensing and cooling facilities. Coal is brought to the plant in barges and delivered by them upon a storage yard just outside the boiler room. A narrow-gauge railway track runs into the boiler room from the coal pile, on a slight down grade, and this greatly facilitates the transportation of the coal.

In dimensions the plant is a brick structure 97 ft. long, 80 ft.

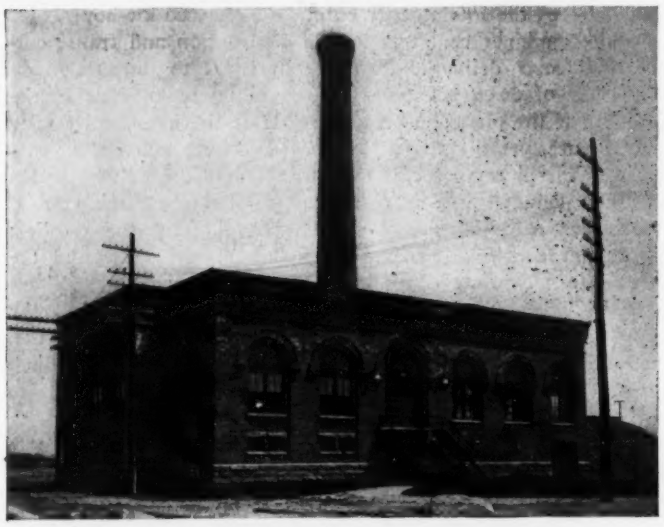


FIG. 2.—EXTERIOR VIEW OF QUINCY POWER STATION.

wide and 37 ft. high. Its area per kw of rated capacity is 6.2 ft. This is, of course, a larger area per unit of power installation than is commonly found in turbine plants, but the Quincy plant is unusually attractive to the visitor for this very reason. The designing engineers, Messrs. Sheaff and Jaastad, of Boston, aimed to secure plenty of room for convenient operation in all parts of the plant, and on a suburban tidewater location land is naturally cheaper than on the water front of a large city. The station is surmounted by a brick stack 125 ft. in height and 5 ft. 6 in. inside diameter. A commodious basement 11 ft. deep is located beneath the engine room and the floor of the basement and building foundations are of concrete. The architectural features of the exterior are simple, but pleasing.

In detail design the plant contains few specially novel features,

FIG. 3.—CONSTANT-CURRENT TRANSFORMERS.

its interest being chiefly in the large number of good points which were incorporated into its structure and equipment. The boiler room, engine room and basement are all supplied with admirable natural illumination. Every part of the plant is easily accessible to the operating force. Passage may readily be had between the foundations of the different units, in the basement, and the pumps and condensing equipment can be handled if need arise by the engine room crane through suitable railed openings in the floor. Excessive compactness of design was not needed, although there is no impression of wasted space in the station.

The boiler room is high studded, and is 62 ft. 6 in. long by 43 ft. in width. It contains two batteries of Babcock & Wilcox water-tube boilers, two feed pumps, a secondary feed-water heater and the usual up-take and breeching leading to the chimney. One battery consists of two 250-hp boilers, each having 108 4-in. tubes 18 ft. long, and two 36-in. water drums, while the other battery is composed of two 350-hp boilers with 144 4-in. tubes each. The narrow-gauge track passes over a pair of platform scales located in front of the furnaces, and all coal is weighed and recorded here before firing takes place. The large width of the boiler room greatly facilitates the coal handling and the light supply. The feed pumps exhaust directly into a secondary feed-water heater, but are provided with an atmospheric by-pass which is used in case the operators desire to repair or inspect the heater. All the pump valves are located at points convenient to the reach of the operating force, and the boiler batteries are connected by a special platform bridge at the top of the drums to facilitate work above the floor level.

In the last fiscal year reported by the Massachusetts Gas & Electric Commission the company burned 1,477 tons of coal and 349 tons of screenings, making an average fuel consumption of five tons per day. At the time of winter peak load in December the daily consumption is about nine tons. This coal is fired by hand, as would be expected in a plant of this size. The operating shifts are three in number, and their duration 8 hours each. Each shift consists of two men, one to look after the engine room and the other the boiler plant. The boilers are fed by city water. The boiler room floor space figures 2.2 sq. ft. per boiler hp.

The engine room is 77 ft. 4 in. long by 50 ft. wide, containing 3.1 sq. ft. per kw. It has three units installed as follows: One 150-kw, 48-pole, 60-cycle General Electric alternator direct-driven by a 12-in. by 22-in. by 30-in. Rice-Sargent engine at 150 r.p.m. One 300-kw, 48-pole, 60-cycle General Electric alternator, direct-driven by a 16-in. by 30-in. by 30-in. Rice-Sargent engine at 150 r.p.m. One 800-kw, 72-pole, 60-cycle General Electric alternator, direct-driven by a 22-in. by 48-in. by 48-in. Cooper-Corliss engine at 100 r.p.m.

All the engines are cross-compound horizontal units and the alternators are of the revolving-field type, generating three-phase currents at 2,300 volts. The alternators are all run in parallel upon a single group of three-phase bus-bars run horizontally above the floor near the top of the switchboard at the rear of the latter. The engine room is served by a 20-ton hand traveling crane of 50 ft. span. The switchboard is set practically flush with the adjacent wall to allow plenty of clearance in operating the crane, and the rear of the switchboard projects a short distance into a bay 43 ft. by 7 ft. wide, which is admirably lighted by half a dozen large windows. Each class of service and the corresponding wiring are, incandescent and power, are sectionalized and segregated, one from the other. Voltage regulation is effected by a Tirrill regulator, and all the field rheostats are located in the basement, on the ceiling of the latter.

There are three exciter units. One is a 20-kw generator direct-driven by a General Electric vertical marine engine of the single-cylinder type, 9 in. diameter by 7 in. stroke, speed 360 r.p.m.; the other two units are induction motor generator sets of General Electric make, including a 20-kw generator driven at 900 r.p.m. by a 30-hp, 220-volt motor, and a 45-kw generator driven at 720 r.p.m. by a 60-hp, 2,080-volt motor. The exciters are all compound-wound machines, delivering current at 125 volts—no load and full load—to a common pair of bus-bars. A jet condenser is located beneath each generating unit, together with an intermediate receiver and a primary feed-water heater. All the condensers are Blake machines. The piping is exceedingly flexible and any unit can be operated as follows:

1. High-pressure and low-pressure cylinders in service, condensing. 2. High-pressure and low-pressure cylinders in service, non-condensing. 3. High-pressure cylinder in service alone, non-condensing. 4. Low-pressure cylinder in service alone, non-

condensing. 5. High-pressure cylinder in service alone, condensing. 6. Low-pressure cylinder in service alone, condensing. The receivers and primary heaters are also by-passed, as is the city water meter. The operating steam pressure is 115 lb.

In the basement beneath the switchboard are also located five 50-light, 30-kw, constant-current transformers, 6.6-amp., 2,200 volts each, and one 100-light transformer. A private telephone system connects the various parts of the plant and in a small booth near the switchboard is a small plug board with private and city telephones. Distribution is effected by both single and three-phase circuits. Several three-phase, 50-hp induction motors are in service and the largest single-phase induction motor in circuit is rated at 10 hp. Taken as a whole, the plant is a pleasing contrast to the belt-driven stations still too frequently found in suburban service.

Combined Lighting and Heating Station.

In some cities of the Central West the old-established lighting companies are experiencing competition from new companies which are installing heating plants in addition to furnishing light and power, and in some cases these combination companies are supplying light and power at practically cost and are taking their profit from the heating end of the business.

An interesting combination heating and electric plant has just been installed at Canton, Ohio, by the Merchants' Heat, Light & Power Company, which company was formed about a year ago as the successor of the Citizens' Heat & Light Company. About two years ago the company was formed in connection with a plan to build a large new hotel, the auxiliary company to supply light and heat for the building. The plant was established at some distance from the hotel in order to eliminate smoke and noise. The hotel company met with financial embarrassment and the new company mentioned took over the franchise for a line through the main section of the town and has since completed a system covering the entire downtown section of the city, the company having secured franchises for underground work on about five miles of streets.

The new company is headed by Mr. Thomas F. Turner, president; Mr. John Rommel, vice-president; Mr. Barnett F. Steiner, secretary; Mr. William Stolzenbach, treasurer and general manager. Mr. B. J. Shockley an experienced lighting man, is superintendent and assistant general manager. The plant was designed and the installation supervised by Mr. E. R. Vincent, of Indianapolis, with Mr. C. C. McLain in direct charge of the work. The contract for the installation of the power plant and the laying of all mains and lines was awarded to the Arbuckle-Ryan Company, of Toledo, which has installed a number of plants of this kind.

Canton was particularly well suited for a combination plant of this kind. It would have been rather difficult to secure sufficient water for operating the plant condensing, thus making the use of the exhaust steam for heating purposes an unusually economical arrangement. The site selected for the plant was within five blocks of the Public Square and at a point about 25 ft. lower than the business district, so that the steam and hot water are returned by gravity. The main streets all have alleys back of them and the lines are all in these alleys, thus facilitating the construction work and the work of connecting up new buildings.

The station building is a plain brick structure, the engine and the boiler room having separate peaked roofs. Ample space is provided, and the arrangement of all machinery and piping is such that the plant can be extended without destroying the symmetry of the arrangement. The engine room measures 43 by 65 ft. and the boiler room 41 by 65 ft. The room is supported by steel trusses and has an asbestos covering. The engine room is served by a crane. The engine room floor is of concrete laid on corrugated plates furnished by the Berger Manufacturing Company, of Canton. On account of the character of the ground it was necessary to use a large amount of concrete in the building and engine foundations. Draft for the grates is furnished by a self-supporting steel chimney 72 in. in diameter and 150 ft. tall. This rests on 14 ft. of solid concrete. Steam is supplied by three 250-hp Stirling water-tube boilers equipped with Roney stokers. Back of the boilers there are two boiler feed pumps and adjoining the boilers are two low-duty pumps. Below the engine floor are two vacuum pumps and a receiver pump. These were all furnished by the Canton Pump Company, Canton, Ohio.

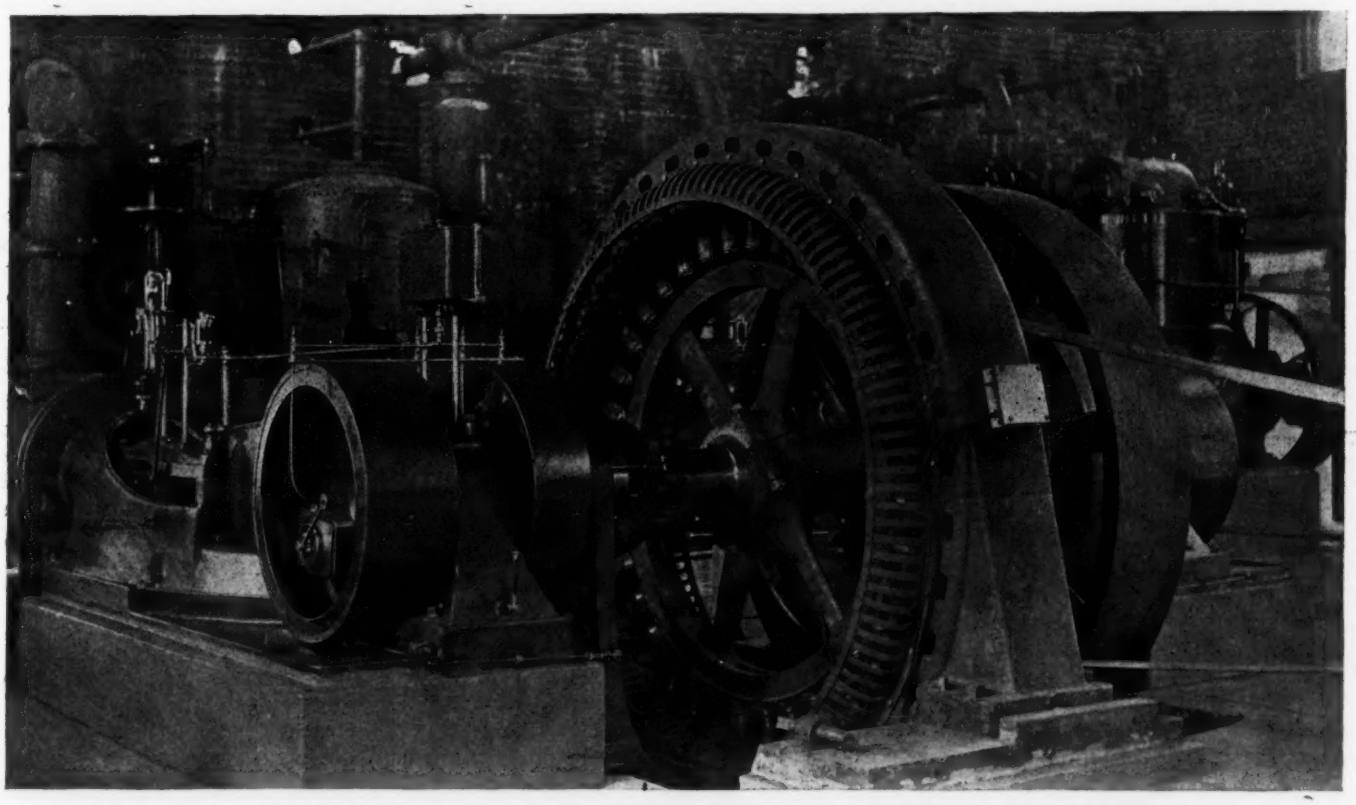


FIG. 1.—250-KW, TWO-PHASE ALTERNATOR IN POWER HOUSE AT CANTON, OHIO.

The two main engines were furnished by the Russell Engine Company, of Massillon, Ohio, and are of the cross-compound type, developing 375 hp each, operated non-condensing. Direct-connected to the shaft of these are two 250-kw, 2,300-volt, two-

phase generators built by the National Electric Company, Milwaukee, Wis. Small 110-volt exciters are belted to the engine shafts. To one of the engines is also belted a 75-kw, 250-volt, direct-current generator, which takes care of the power load under light load conditions. There is also in the engine room a Westinghouse vertical engine operating at 295 r.p.m., and developing 160 hp, which is belted to a 125-kw, 250-volt, direct-current Westinghouse generator. At one side of the engine room there is a grey marble switchboard with instruments for controlling various machines and lines.

The low-pressure cylinders of the engines exhaust into 8 and 10-in. pipes, leading into a 16-in. heating main. The underground system covers about five miles of streets embracing the business district of the city and some of the best residence streets. Leaving the station at 16 in. in diameter the steam main runs up to the center of the town, branching north and south through the business district at 14 in. and is gradually reduced to 2½ in. on the smaller branches. Below the main steam line is a 4-in. return line to the station. The returning steam and hot water go to a 1,000-hp Cookson feed water heater in the engine room and this also receives any surplus exhaust steam from the engines. A 6-in. live steam line is taken direct from the boilers and carried

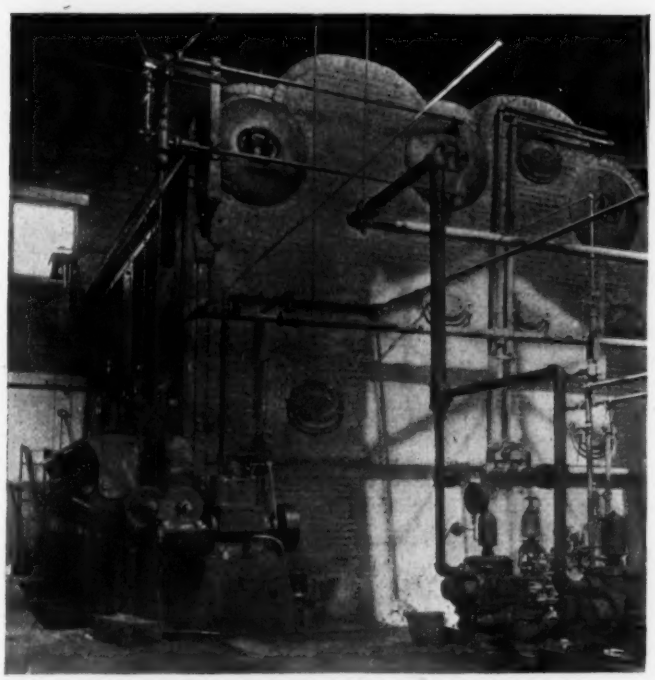


FIG. 2.—BOILERS AND PUMPS.

alongside the main steam line and tapped into it at several points in the system. This live steam line, or booster line, as it is called, maintains the pressure and raises the heat in extreme weather.

Each room or group of rooms in a building to be heated is supplied with a thermostatic control valve on the incoming line, which automatically maintains the temperature at any predetermined point between 60 and 80°. These thermostats are operated by a 1¼-in. air line, and compressed air at 15 lb. pressure is supplied by a 9½ by 9½ Westinghouse air pump. In a number of buildings air tanks have been installed, enabling customers to utilize air for sweeping or for other purposes.

The main steam lines are covered with Wykoff pipe covering. Adjoining the pipe is a tube of tin, then a layer of sheet asbestos, then one inch of strips of wood bound with piano wire, then a layer of felt paper; this is then asphalted, then another layer of felt paper asphalted, another layer of wood strips bound with wire and the whole is then asphalted and rolled in sawdust, making a covering about 2½ in. thick.

There are manholes leading to the underground system at every street corner all over the district. The steam and return lines have bronze expansion joints at each manhole, and the various joints are trapped to the return line. The manholes are made very large so there is space to work around the pipe. The manhole covers are 36 in. in diameter and are set in a square frame made up of 7-in. eye beams and covered with Berger plate and 2 in. of concrete. There is a special lug on the cover giving a hinge effect so that it can be readily opened, and radiation is prevented by a packing of 4 in. of wool felt.

The lighting cables are carried in vitrified clay conduits embedded in 6 in. of concrete. Between manholes they are carried above the 16-in. steam main, while in the manholes they are carried around the sides, thus making them readily accessible. The high-tension feeders are No. 2 and No. 4 lead-covered wire, while the low-tension feeders are 500,000 cir. mils paper-covered and rubber-insulated copper cables. Five extra ducts are laid for future extensions of the feeder system in the downtown district.

The company's franchise gives it the privilege of making a charge of 35 cents per square foot of radiation per season or 60 cents per thousand lb. of water of condensation through a meter; but to meet the competition of 30-cent gas for heating purposes this figure has been reduced to 31½ cents per square foot per season, or 60 cents per thousand under the meter arrangement. The company guarantees a temperature of 70° at 10 below zero and measures radiation by the rule known as the 2-20-200 formula. It is figured that the present equipment of approximately 1,000 hp will give 250,000 ft. of radiation at 250 ft. velocity, and with additional equipment for which the station is designed this heating capacity can be doubled without increasing the mains.

The heating system was not placed in operation until late last winter and several of the largest buildings in the city were heated with very satisfactory results. It is believed that next winter the company will be able to dispose of a maximum output for the present capacity.

While the heating business furnishes a very handsome return at little additional expense, the policy of the company will be to build up its lighting business and make the load as large as possible, thereby being placed in position to supply additional steam for heating without the expense of firing boilers and using live steam.

The company's rates are 10 cents per kw-hour for one hour connected load and 6 cents per kw-hour above that. It is meeting with a great deal of success in introducing Nernst lamps in stores and residences and has several hundred of these now in use. They are run on a 230-volt circuit and consume 88 watts per glower. The company maintains the lamps. It has a commercial load of about 60 amp. at present on the 2,300-volt circuit and is adding to this very rapidly by progressive soliciting and advertising. A good power load is being worked up and considerable success met in introducing such novelties as flatirons, curling irons and other heating apparatus. It has under consideration a plan to install an ice machine, thus utilizing the exhaust steam also during the summer months.

Utilization of Waste Gases.

A recent issue of *Mines and Minerals* contains some interesting comments on the advantages to be gained from using waste furnace gases for driving gas engines. It is shown that for each ton of iron produced there is wasted an amount of heat equivalent to about 675 hp-hours of developed energy, assuming that the efficiency of the gas engine is 26 per cent. Since a modern blast furnace has a capacity of 23 tons per hour, one such furnace can furnish sufficient gas to supply 15,525 hp continuously. Deducting the amount needed for blowing engines, pumps, etc., there would be available for outside work 9,775 horse power.

About three years ago the Lackawanna Steel Company installed sixteen 2,000-hp engines for operating blowing machinery, and eight 1,000-hp engines for direct-connection to electric generators. The Carnegie Steel Company has reecntly purchased four 3,000-hp gas-driven blowing units and two gas engines direct-connected to electric generators, one of 2,000-kw and the other of 2,500-kw capacity. In the rail mill at Braddock, Penn., gas engines operating on furnace gas now run several large electric generators which furnish power for the mill machinery, while at Worcester, Mass., the American Steel and Wire Company is equipping its plant with an 800-hp gas engine for a like purpose.

Cooling the Engine Room—and the Engineer.

BY JAMES F. HOBART.

Running an engine and generator during the hot months is no joke to the man ordinarily affected by heat and humidity. There are, however, a number of ways by which an engine room may be made fairly comfortable, and many of these ways are within reach without the expenditure of much money and at the cost of a little time and ingenuity.

There are very few engine rooms but which can be made much more comfortable by means of proper ventilation, and by covering some of the steam pipes and other heat-radiating surfaces. This will touch a tender spot on some engineers and engine owners who seem possessed of the idea that heat economy requires a temperature of 120 to 140° in the engine room in order to save as much heat as possible. There is no reason why the temperature of an engine room should rise more than 5 or 10° above that of the rest of the building, and if some attention is given towards keeping the humidity of the atmosphere as low as possible in the engine room then it will be fairly comfortable even when the outside thermometer ranges from 85 to 90° F.

To begin with, see that all possible radiating surfaces are covered with some material which is a bad conductor of heat. There is not one owner of a plant in fifty who will not permit the engineer to procure adequate pipe covering if the matter is properly and timely placed before him, and that single owner will permit the engineer to make himself comfortable if it be without much expense to the owner.

With the radiating surfaces properly covered, and all steam leaks fully stopped (steam leaks are bad things for the engineer, who would be cool, for leaks not only increase the heat of the atmosphere, but the humidity also, thereby making the heat feel worse than it really is), see that there is plenty of ventilation and that fresh air can come in freely and drive out the heated air, which is sometimes very foul air also. It sometimes happens, from the peculiar construction and location, that there is a great lack of ventilation, and too frequently the ventilating feature is overlooked entirely.

In such instances it is almost always useless to appeal to the powers that be for relief. The engineer must work out his own salvation if he has any. To that end proceed to establish a ventilating fan which will drive the heated air from the room, and put in conduits to take out the vitiated and bring in pure air. These tasks are both easy of accomplishment even if they do appear formidable at first sight. Assuming that an electric fan is out of the question, a fan is very easily provided by simply placing a vane or a fan blade on each arm of the engine pulley, close to the rim, and extending as far toward the hub of the wheel as may be found necessary or conditions demand. In a wheel twelve to eighteen feet in diameter, vanes or "paddles" three feet long, extending inwardly from the rim, are sufficient to move a great deal of air each hour. Small high-speed wheels may have the vanes fitted from rim to hub, and securely fastened to both by a pair of strap yokes made U-shaped and bolted through the vanes and through a cross stiffening piece of wood or metal. These U-straps cost only a few cents apiece and may be had from any carriage smith who uses any number of them for clamping together the iron and wooden parts of wagon axles. Indeed, by raiding broken-down carriages at almost any stable, enough U-straps may be secured for a quarter to fit up an entire wheel with vanes.

The wheel must then be cased in, preferably with wooden sheathing, which painted forms a neat job. The writer once, being hard put for material to close in a main wheel, used sections of packing boxes from a nearby grocery store. The hideous looking boxes, all sizes and colors, were covered with a thickness of deadening felt (thick paper used between floors of buildings) glued on, and finished with a coat of paint. No one ever asked if the wheel case was made of mahogany or aluminum. The conduit can be made in the same manner, four strips of board or scantling being placed where the spout is intended to go, and then the scantlings are sheathed with old box boards, put on crosswise and finished with sheathing felt and paint. Of course, where better material can be obtained, the engineer will not bother with grocer's boxes, but this expedient is cited to show how easily the thing may be arranged even when the "Old Man" will not "stand for it."

Arrange the air conduit to pass out of doors in some obscure corner or out-of-the-way place if possible; but if that cannot be done, do not be discouraged. One engineer vented the foul air through the one window which was of the most value for light. To do this one sash was removed and placed in another home-made frame a foot or so inside its former location; then the air conduit was built into the side of the frame thus made, which obstructed no light at all.

In one engine room the foul air conduit was made from seven lime barrels which were strung on pieces of 2-in. by 2-in. scantlings and securely nailed thereto, the barrels being placed end to end and fitted as closely as possible. They were then wound with strips of burlap, which were stretched as tightly as possible, then filled with glue size and painted. The engineer had ornamented this very unique proposition by painting stripes around the barrels at intervals where the hoops bulged. The result was not to be despised, even for appearance.

The amount of air which may be removed from an engine room by one of these home-made wheel fans will surprise the engineer who figures the amount. As a matter of precaution, always put a damper in the foul air pipe or provide some other means of closing it wholly or partially when, as often will be the case, it is not desirable to remove so much air from the engine room.

One more point must surely be thoroughly covered, or the ventilating scheme will be a failure—provision must be made for admitting to the engine room as much cool air as the air forced out by the wheel fan. Without thus supplying the necessary quantity of air, the whole thing falls flat. There is no air-making outfit in an engine room, therefore provide for a supply through as big an opening as leads out to the discharge of the fan. It is evident that the air supply should be taken from some place where the air is as pure as possible. It would not work well to take the air supply from the top of the boiler, or from some place where there are obnoxious gases, therefore do a little engineering and obtain air as pure as possible. Sometimes a belt box may be made to do duty for a fresh air channel, or a hole in the wall between inside and outside sheathing can be used. In one case at least the engineer used an abandoned smoke stack as a source of air supply, the wheel fan drawing the necessary supply from a height of about 40 ft. above ground, thereby obtaining a supply of very good pure air.

But the mere changing of the air in the engine room and the insulation of the heat radiating surfaces is not by any means all that the engineer can or should do to keep cool in hot weather. The engineer always has at hand that greatest of all cooling agents—water—and it is no one's fault but his own if he does not use it to the limit. As simple as the matter seems, not one engineer of a dozen knows, or at least practices, the simple yet very effective method of cooling the person by wetting the arms below the elbows. There is hardly a single other thing which will so quickly and effectively reduce the feeling of heat and oppression during a hot humid day as to plunge the forearms into a body of cool water, or to hold the arms under a stream of running water. The faucet in the sink will answer. Just roll the sleeves above the elbows and douse the arms under the slow running stream of water. Relief is felt at once, and the cooling effect is quickly carried to other portions of the body by the blood as it returns from the arms.

This method of applying water to the body when heated is a safe one. The amount of surface exposed to the water is so slight that it is hardly possible to take a chill by so doing. In fact, if the water be applied too long to the arms in the attempt to cool the entire body, there will be felt such a great pain in the forearms that the person trying the matter is glad to take himself out of the wet before any real damage has been done.

In addition to the frequent arm bath, wetting the head is very productive of coolness over the entire body. Do not plunge the head into a vessel of water. That is a very questionable operation for a hot day, or for any other day when the body is heated. Just let the water run upon the hands and wet the hair with the

fingers. Wear the hair very short in summer—that is a great step toward coolness—and rub the water well into the hair with the fingers. If the engineer is possessed of a good strong heart, the water may be rubbed well down on the back of the neck when wetting the back of the head; but no person with a weak heart will care to use water thus on the back or sides of the neck, or perhaps, on the head at all. The great cooling effect of the cool —never ice-cold—water on the veins and arteries of the head and neck is quickly transmitted to the heart by the returning blood, and the condition of that organ should be well known before a sudden shock is applied to the system via cold water on the circulating pipes.

The head and arm cooling business is not for use once or twice a day, but it should be applied as often as benefit is derived from its use. The writer, who finds the water method very beneficial, applies the arm and the head wetting both at least each forty minutes during the very hottest and most humid days experienced in the latitude and longitude of New York; but some persons would have to use either or both methods more sparingly.

Another great cooling and comfort-making device should never be neglected by the engineer, yet it is safe to say that not more than one engineer—electrical—in one hundred avails himself of the privilege. I refer to the shower bath. How many engine rooms are fitted with one? There are a few, but not one where there would and should be scores. There is not an engine or a boiler room in the world where it is not possible to improvise a fine shower bath with little trouble, and at a very trifling cost, and the shower can be fitted with either hot or cold water or anywhere between the two. at the will of the user.

There can be but one reason for this lack of a great cooling, comforting and health-giving arrangement, and that is, I am sorry to say, because the engineer is not aware of the benefits to be obtained from the free use of the shower bath. I will not enter upon a discussion as to the why and wherefore of the benefits to be derived from a frequent use of the shower bath. I will only state that there is no other known restorative agent which acts as promptly and effectively when a man feels worn out and "done up" as a hot shower, a cool shower and a quick rubdown. It puts more and better life into a man, and it largely removes that craving experienced by some men for beer or something stronger, when very tired or heated.

This article deals with the many methods of extemporizing and setting up shower baths. Each engineer can easily work that out to suit individual conditions. But let me say one thing: If you have never been in the habit of freely using the shower bath, go somewhere and try one a few times and it is sure that you will come home with the unalterable determination to have one of your own in your own engine room, and have that quickly.

But there is one other point which bears greatly upon the matter of keeping cool in hot weather. The shower bath is all right for occasional or for regular use, but no day should be commenced without putting the entire body in the best possible condition to resist the heat (or the cold, too) of the coming day. When a man sleeps his body throws off quite a measurable quantity of matter through the pores, and certainly no person should care to go to work with the surface of the body plastered with a coating of dead matter which has been thrown off through the pores of the skin. It makes a great difference in the feeling of the body during the day, whether or not this refuse matter has been removed, or whether it is left plastered over the pores of the skin.

To rid the body of the impure matter, bathe as soon as you are out of bed in the morning. Use whatever means are at hand —bath tub, shower bath—or failing any of these conveniences, use a basin of water, warm or cold, as suits best. Some people are advocates of a cold plunge bath the first thing in the morning. Let them have it if they wish, I do not. Many people have no use for the cold bath, and their preferences are to be respected. A cold bath will do no good if it distresses the person.

To get rid of the "personal oxide" it is only necessary to rub the body lightly with a cloth dipped in water. A sponge is apt to be an unsanitary refuge of microbes, although one of the artificial rubber sponges may be safely used. A little soap may be used, but very sparingly. Twice a week is enough for a thorough use of soap. Go over the body quickly, wringing the cloth frequently and changing the water in the basin whenever it becomes discolored. Dry the body quickly on a rough or Turkish towel, and throughout the day, be it ever so hot, there will be that sense of bodily freshness which is never felt when the pores are closed with refuse matter from the body.

Practical Points in the Operation of Motor-Balancers.

By William Kavanagh.

The switchboard of an electrically-driven plant employing a motor balancer is usually equipped as follows: The motor switches are two-pole, the lighting switches three-pole and the voltmeter is connected so that by shifting a rotary switch the voltage on either side of the mains can be ascertained. In addition to the usual equipment of circuit-breakers, ammeters, voltmeters, recording watt-hour meters, etc., the board is fitted with the controlling mechanism for operating the balancer set. This consists of one two-pole switch one single-pole switch and a starting rheostat. Since the motor switches are two-pole and the lighting switches are three-pole, it will be understood that two distinct voltages can be obtained. The motors are usually operated with the higher voltage while the lower voltage is employed for the lamps. The motor mains lead from the switchboard in pairs to the different motor panel boxes, while the lighting mains have three wires and connect with the various lighting panel boxes conveniently located on each floor of the building. If now one were required to start a plant fitted as above described, the procedure would be as follows: First clear the board of all lighting switches and close the circuit-breakers. Then start the generator and having obtained the correct voltage close the main switch. After the generator is connected to the bus-bars, the balancer set may be started by closing the two-pole switch and drawing the operating lever of the starting box across the contact points. When the motor balancer has attained full speed, the single-pole switch may be closed and the plant is ready for operation.

Motor balancers are subject to the same ills as other electrical apparatus and the attendant should always be ready for emergencies as one of the most serious accidents that can befall an electrical plant is the breaking down of the balancer set. Whatever may be the nature of the accident, it must be repaired at once and the motor balancer placed in operation again before any of the lighting switches are closed.

When the system is alive the balancer should always be kept running, otherwise with an unbalanced load the lamps on the side carrying the lesser load will be burned out. In practice tripping coils are placed on all the main circuit-breakers so that when the arm of the rheostat opens the balancer circuit, the circuit across the auxiliary contacts is closed and the main circuit-breakers thereby tripped. Where this does not obtain it will be necessary to pull all the lighting switches when anything happens to the motor balancer. It will of course not be necessary to open the motor circuits.

If both sides of the three-wire system were balanced and the voltage between the outer wires were 250, the voltage between each outer wire and the neutral would be 125. In practice, however, it is impossible to realize this condition, and the voltmeter may indicate 124-126, 122-128, 127-123, 115-135, or 110-140. In each case, however, the sum of the voltages is equal to the voltage across the outer wires. If the lines are fairly balanced the difference will not be greater than 2 or 3 volts.

The circuit-breaker may open from a number of causes such as a short-circuit, throwing in switch while the operating lever of the starting box remained on closed circuit, etc., and when this occurs it is best to pull both the lighting and motor switches. After all the switches have been pulled the circuit-breaker may be closed and the balancer again started. The switches may then be thrown in one after the other and the circuit upon which the fault is, thus located. When closing down for the night all the lighting and motor switches should be pulled, and afterwards the two-pole and single-pole switches of the balancing set. The engine and generator may then be shut down in the usual manner.

Reversing Shaft Governor Engines.

By W. H. WAKEMAN.

DIRECTIONS for reversing slide valve throttling engines, or any other kind in which an eccentric is fastened to the crank shaft, are found in many books and papers, although if some of them were strictly followed the engine would not run in the opposite direction, while others would cause them to revolve, but at a great disadvantage, so far as use of steam is concerned.

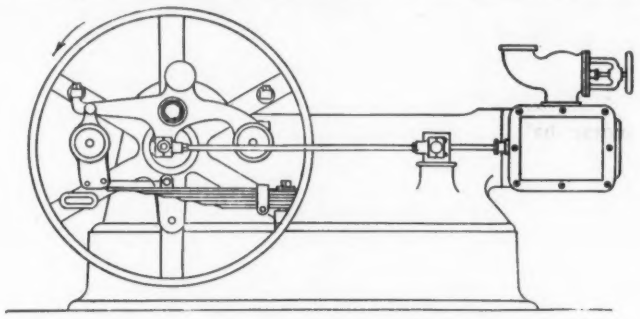


FIG. 1.—SKINNER ENGINE.

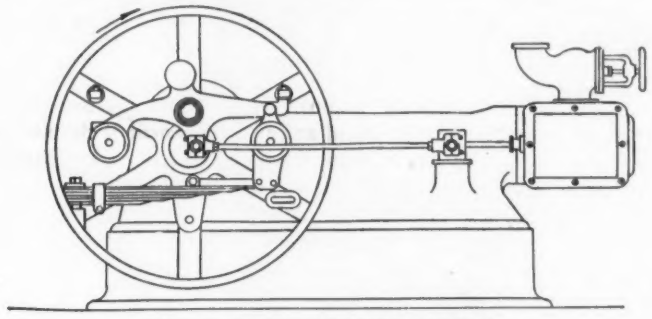


FIG. 2.—SKINNER ENGINE REVERSED.

There are many kinds of engines to which these do not apply, and it is more or less difficult to secure reliable information that will enable an engineer who is not an expert to reverse them, especially if they are of the high-speed, automatic type, with shaft governor. This article was written to supply such information in a plain and practical way.

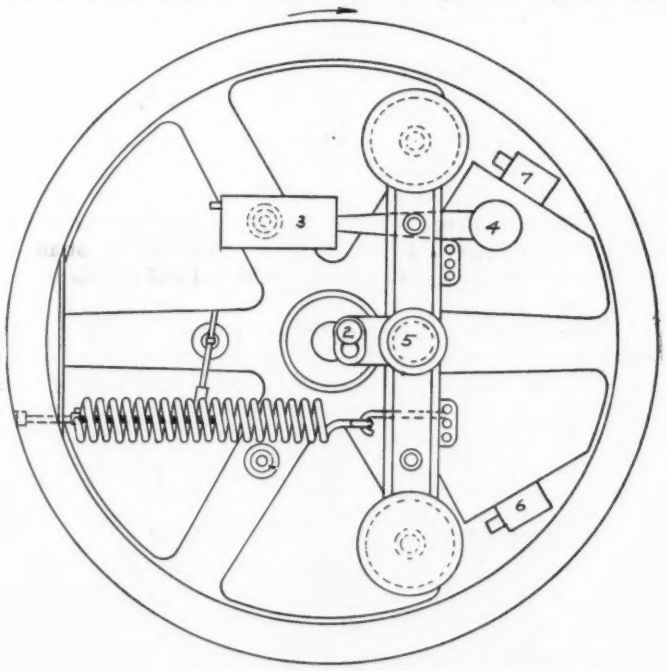


FIG. 3.—M'EWEN SHAFT GOVERNOR.

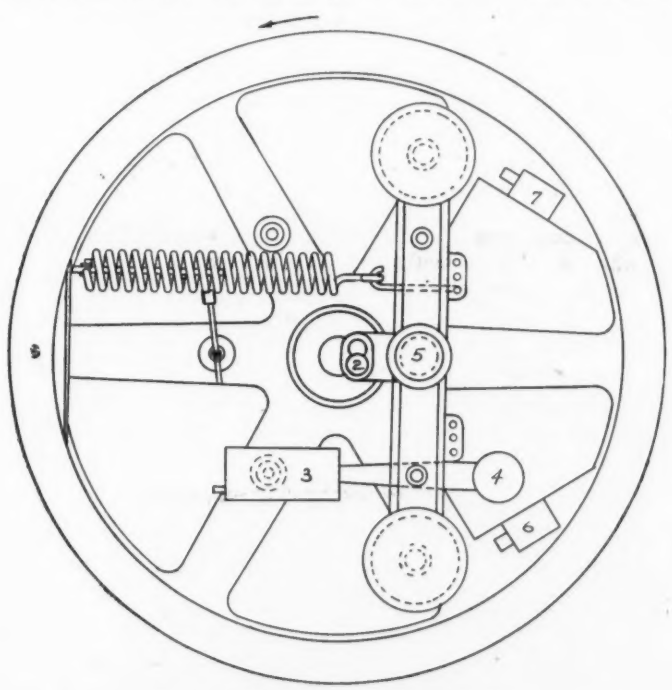


FIG. 4.—M'EWEN GOVERNOR REVERSED.

Fig. 1 illustrates the Skinner engine with governor set to run "over" as indicated by the arrow, or in other words, the top of the fly-wheel travels from the cylinder. This is a left-hand engine because when viewed from a point in front of the cylinder the governor wheel is at the left-hand side. This applies to both direct-connected and belted engines.

When it is desired to run this engine in the opposite direction or "under," as shown in Fig. 2, the long-weighted arm must be taken off and turned "end for end" to use a common expression. The heavy six-leaf spring must be turned in the same way.

These two illustrations show the appearance of the governor for both directions of travel, therefore if the engineer in charge of an engine of this kind wishes to reverse it, he can do so by placing the parts as plainly indicated and he can do this without understanding any of the theory of the operation if he has not time enough to study this interesting part of his business.

It will be noted that the wrist pin which carries one end of the valve rod is located to the left of the center of crank shaft in Fig. 1 and to the right of it in Fig. 2, showing that its relation to the position of crank is changed by the reversing process. As the wheel revolves, this wrist pin describes a circle around the center of the crank shaft as seen in these illustrations. When the engine is started this circle is comparatively large, giving the longest possible point of cut-off, and it assumes this position whenever a full load is thrown on, but for all lighter loads the circle is smaller accordingly, giving a shorter point of cut-off.

In these two illustrations I have presented outlines of the whole engine in order that the matter may be well understood, but this is not necessary in other cases, therefore only the governor in each case will be shown.

Fig. 3 illustrates the McEwen right hand engine governor set to run "over." The wrist pin is shown at 2 and it will be noted that there is another hole in the arm directly below it; 3 is a dash pot, and as centrifugal force interferes with its free operation at high speeds, the weight, 4, is provided to counterbalance it and prevent undue friction. The governor arm is pivoted at 5 and a rubber buffer is provided at 6 for its extreme travel in one direction, and at 7 for the opposite extreme.

Fig. 4 is the same governor set to give motion in the opposite direction. The wrist pin, 2, is now in the other hole provided for it, and all figures refer to the parts mentioned in connection with the preceding illustration.

When changing a governor to give a reverse motion, care should be taken to preserve the tension of whatever kind of spring is used. This can be done in the case of a spiral (or more properly speaking, a helical spring), by noting the distance between the coils before disturbing them, and restoring it carefully after the desired change is made.

Another point to be considered in this connection is that in this case and perhaps in others there are two ways of altering the strength of spring. One is to give the coils more or less tension, and the other is to increase or decrease the number of coils in tension by a device not shown in the cuts, but which will be readily seen on the engine.

Fig. 5 illustrates the Rites governor as used on the Water-

town engine, when revolving in the direction indicated by the arrow, and Fig. 6 shows the same governor when adjusted to run in the opposite direction. As these governors are used on several high speed engines it is not practical to mention all of them here, but engineers in charge of any engine controlled

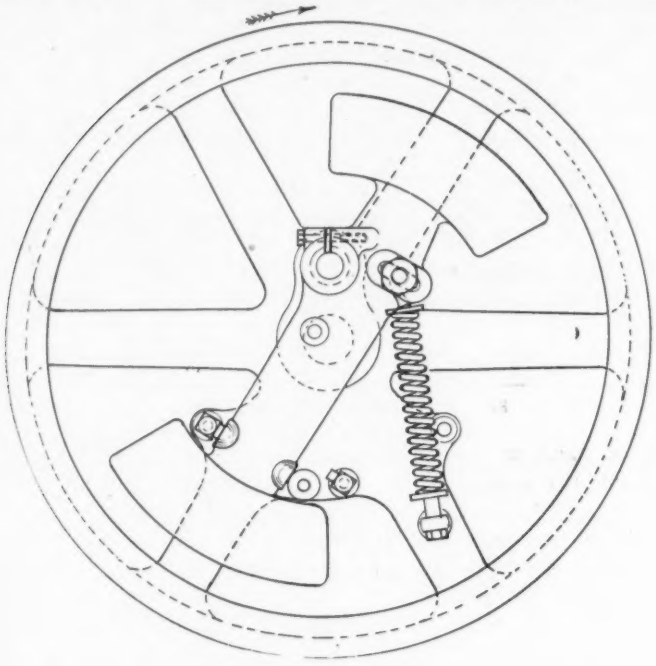


FIG. 5.—RITES GOVERNOR.

by a Rites governor can learn how to reverse it by studying these two illustrations.

For illustration, suppose that when one of these engines is compared with the illustrations that it agrees in direction of motion and form of adjustment with Fig. 5. If the engine is to be reversed then it must be changed to agree with Fig. 6. To do this it is necessary to take off the governor arm and turn it over, then change the location of pins which serve as stops, also to change the spring pin which holds the outer end of the helical spring.

It is not practical to state which is for an engine running "over" nor for one traveling "under," but the following rule

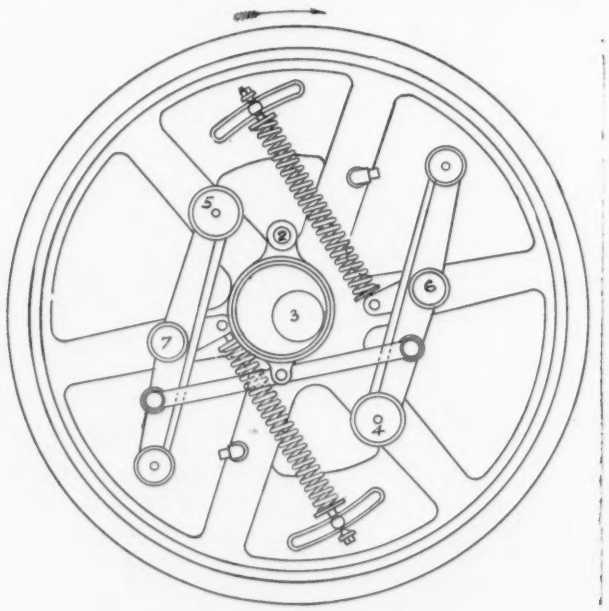


FIG. 7.—HARRISBURG GOVERNOR.

applies in such cases. An adjustment that is correct for a right hand engine running "over" will also answer for a left-hand engine running "under."

In all engines before mentioned movement is given to the valve by means of a wrist pin revolving in a circle about the center of crank shaft. In others the same result is secured by an eccentric that encircles the crank shaft but is neither fitted nor fastened to it. When the load varies the governor causes this eccentric to swing across the shaft like a pendulum, causing the center of eccentric to approach or recede from the center of shaft as the case may be, thus giving the valve a longer or a shorter stroke, exactly as the wrist pin does on engines already mentioned.

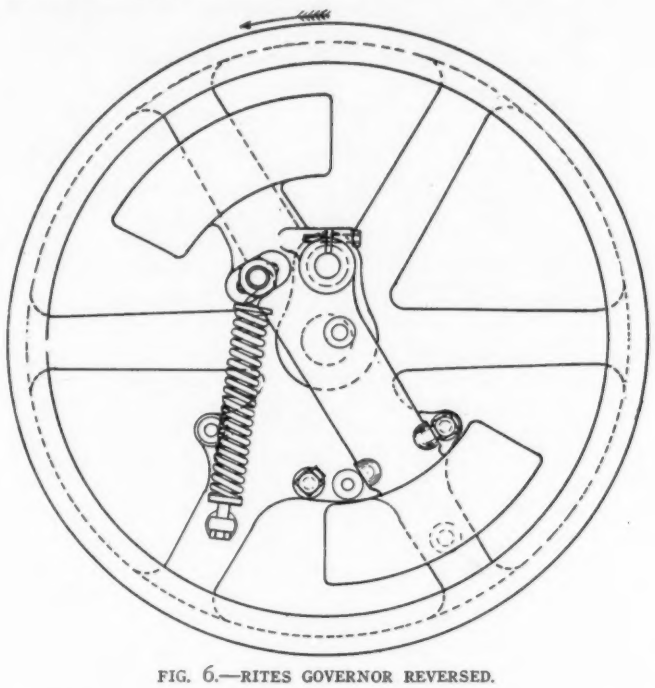


FIG. 6.—RITES GOVERNOR REVERSED.

Fig. 7 illustrates a governor of this kind as used on the Harrisburg engine when revolving as indicated by the arrow. The eccentric is pivoted at 2 and swings across the shaft, 3, as described, by action of the weights, 4 and 5, which are pivoted at 6 and 7, respectively.

The action of these weights is opposed by the two helical springs the outer ends of which are adjusted in slots. After reversing this governor if it does not respond quickly to changes in the load, move the ends of these springs toward the rim of wheel, but if too sensitive move them towards the center. While these slots are not parallel to any of the spokes, they are inclined sufficient to make these directions clear.

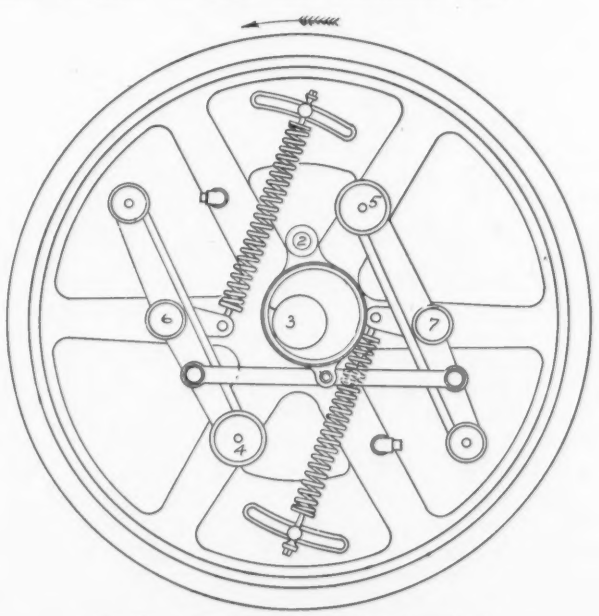


FIG. 8.—HARRISBURG GOVERNOR REVERSED.

Fig. 8 is the same governor when set to run in the opposite direction. Numbers refer to the same parts in both illustrations.

Some of the shaft governor engines cannot be reversed, therefore if the flywheel of such an engine must run in the opposite direction for any cause, it is necessary to turn the engine around to secure desired results. The Straight Line engine is a sample of this class. There are others that could be made reversible, but the builders have never considered it necessary to develop

this feature. The Erieco engine is an illustration of this kind.

Concerning the need of information that will enable an engineer to reverse an engine, the following incident will serve as an illustration. A certain engine rated at 300 hp, was sold to be removed. When erected in its new position the engineer

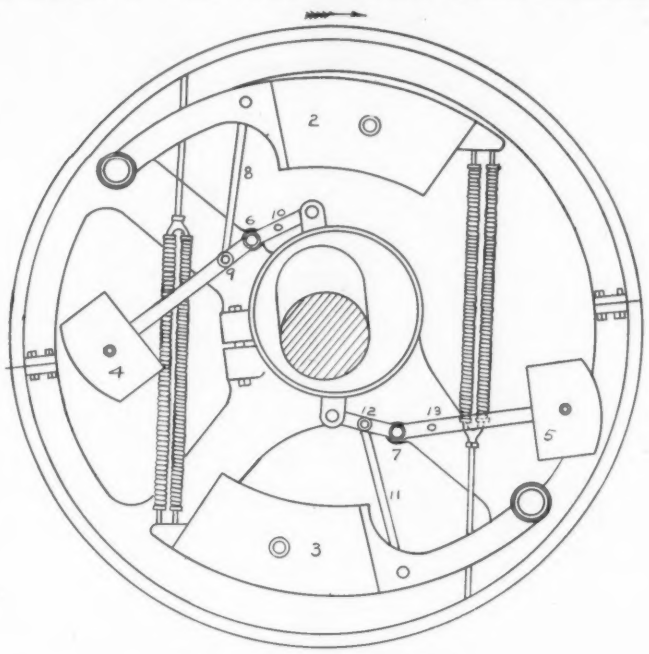


FIG. 9.—FITCHBURG GOVERNOR.

discovered that it revolved in the wrong direction, as it turned his machinery backward. He decided to cross the main belt as the only practical way to provide a remedy, but a friend advised him to reverse the engine and he engaged a more competent engineer to do it. Under some conditions an engine looks very awkward when running "under" and there are very few that really operate as well when turning in this direction, but if the main belt on one of this size should be crossed, much extra friction would result in wearing the belt rapidly.

Fig. 9 illustrates the Fitchburg engine governor set to run as indicated by the arrow. While this appears like a complicated piece of mechanism, it really is one of the most simple governors to reverse that is now in use, except that a new eccentric must

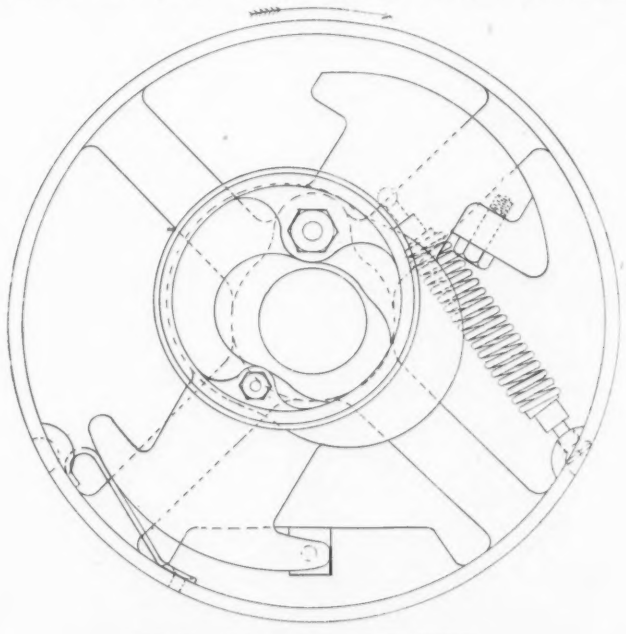


FIG. 11.—MODIFIED RITES GOVERNOR.

be substituted. When in the position shown the governor is at rest, and the helical springs draw the heavy weights, 2 and 3, inward, thus raising the eccentric to its highest position, and as this gives the valve its longest possible stroke, steam is admitted for three-quarters stroke of the piston. When revolving, centrifugal force throws the weights, 2 and 3, outward against the force exerted by the helical springs. This forces the eccentric downward across the shaft (which is shown in cross section), until the opposite extreme is reached which almost entirely cuts off supply of steam to the cylinder. Variations in the load will give the governor intermediate position.

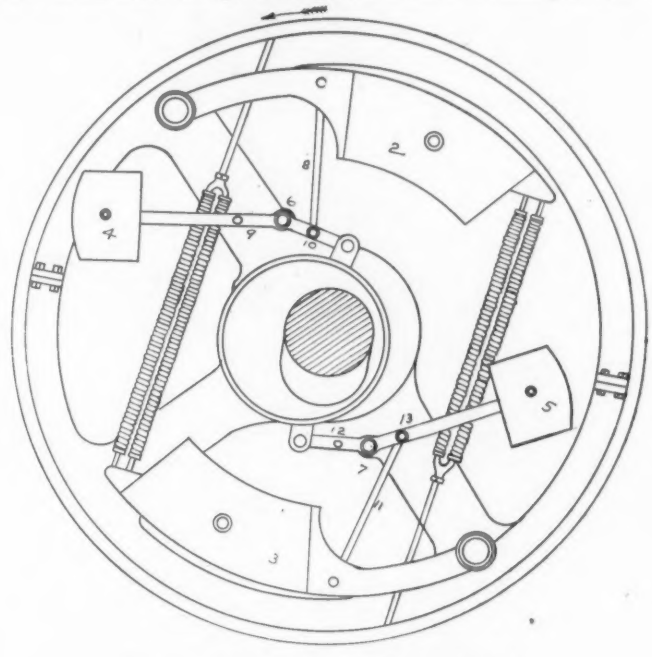


FIG. 10.—FITCHBURG GOVERNOR REVERSED.

The auxiliary weight, 4, operates with the main weight, 2, as it is pivoted at 6, but the other auxiliary weight, 5, operates against the main weight, 3, as it is pivoted at 7, therefore 4 and 5 balance each other, but taken together they resist changes in speed, therefore the result is a very steady speed under varying conditions.

Again referring to Fig. 9 if we disconnect the link, 8, from the pin, 9, and connect it at 10 as the weights are thrown outward by centrifugal force, it throws the eccentric in the opposite direction, as it is pivoted at 6. By disconnecting the link, 11, from 12 and connecting it at 13 it also reverses motion because it is pivoted at 7 and we then have the governor shown in Fig. 10 ready to operate as indicated by the arrow. It is necessary,

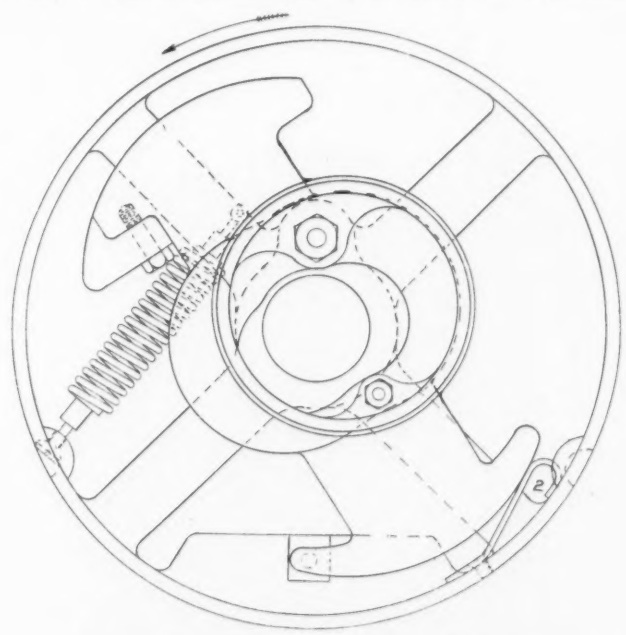


FIG. 12.—MODIFIED RITES GOVERNOR REVERSED.

however, to substitute another eccentric with a different offset.

Fig. 11 is a modification of the Rites governor shown in Fig. 5, both revolving in the same direction, but it carries an eccentric instead of a wrist pin. The latter is used on engines with the governor near the end of crank shaft, and is called an outside connection. The former must be used on engines with

the governor between the wheel and the bearing, called an inside connection, but it can also be used on outside connected engines. An eccentric affords more wearing surface, but it travels fast accordingly, creating more friction, and requiring more lubricant to keep it cool. A wrist pin contains less wearing surface, but with first class lubrication it proves durable because the speed of its surface is much less.

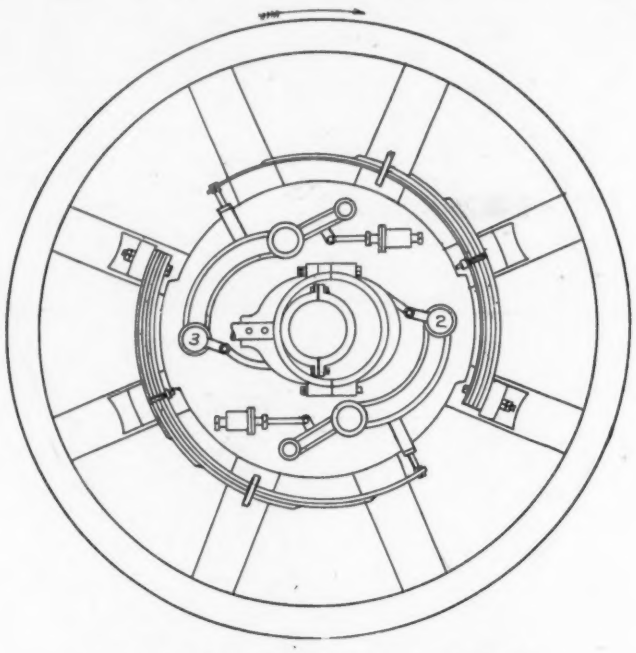


FIG. 13.—M'INTOSH AND SEYMOUR GOVERNOR.

Fig. 12 is the same governor set to revolve in the opposite direction from Fig. 11, or the same as Fig. 6. A buffer spring is shown at 2 which tends to hold the governor steady under sudden changes of load. It is used on the Brownell engine.

The action of governors heretofore shown gives the valve a long stroke for a heavy load and shortens it when a part or all of the load is revolved, but following illustrations show governors that give the valve a constant stroke under all changes. The cut-off is performed by rolling the eccentric forward or backward as the case may be, to meet changes in load. Of course the eccentric must be a sliding fit on the shaft for this purpose.

Fig. 13 represents the McIntosh and Seymour governor which belongs to this class. Centrifugal force throws the weights, 2 and 3, outward, thus drawing the eccentric forward or in the direction of motion, and this regulates the amount of steam taken at every stroke. This action is resisted by the two heavy leaf springs shown.

Fig. 14 is the same governor set to revolve in the opposite direction. Centrifugal force tends to adjust the position of eccentric to the load as before, giving very good regulation.

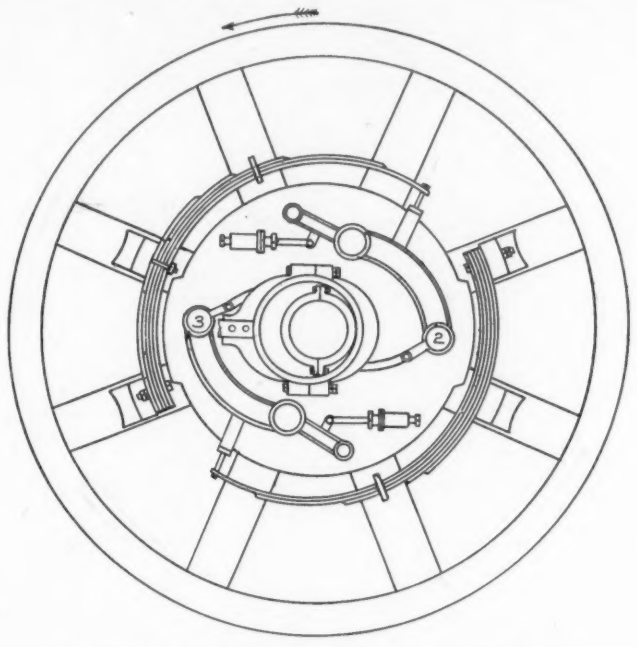


FIG. 14.—M'INTOSH AND SEYMOUR GOVERNOR REVERSED.

Fig. 15 shows the Buckeye governor which is claimed to be the pioneer in this line. In this position the two weights are drawn inward as far as possible by the stout helical springs, forcing the eccentric backward on the shaft and giving a long point of cut-off. The auxiliary springs, 2 and 3, are now under full tension and assist in regulating speed, but are in contact only during the first half of the outward movement of the weights. During the latter half of this movement they are not in contact, as greater tension of the main springs, due to elongation of them, renders it unnecessary.

Fig. 16 shows the same governor set to run in the opposite direction. This is accomplished by changing all connections to opposite places, and taking care to set the auxiliary springs as above described. Fig. 17 illustrates the governor used by Clark Bros. to advance or retard the eccentric on the crank shaft. The weights, 2 and 3, are thrown outward by centrifugal force which is opposed by the helical springs. Arms carrying these weights are pivoted at 4 and 5, respectively, and the shaft is shown at

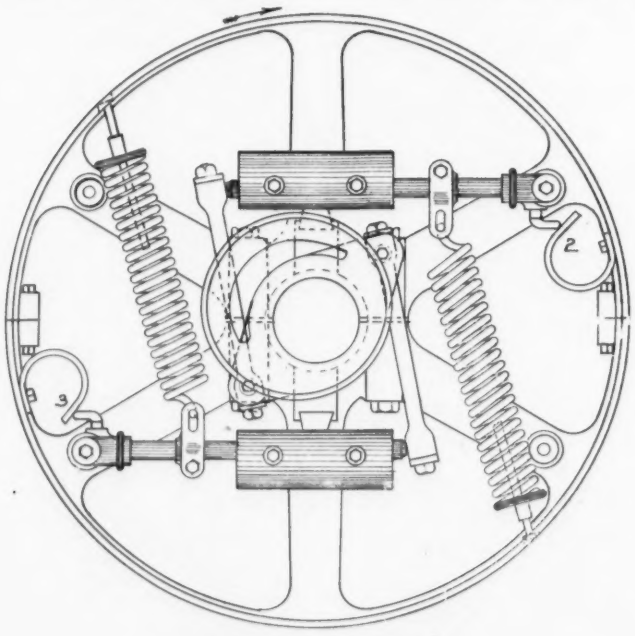


FIG. 15.—BUCKEYE GOVERNOR.

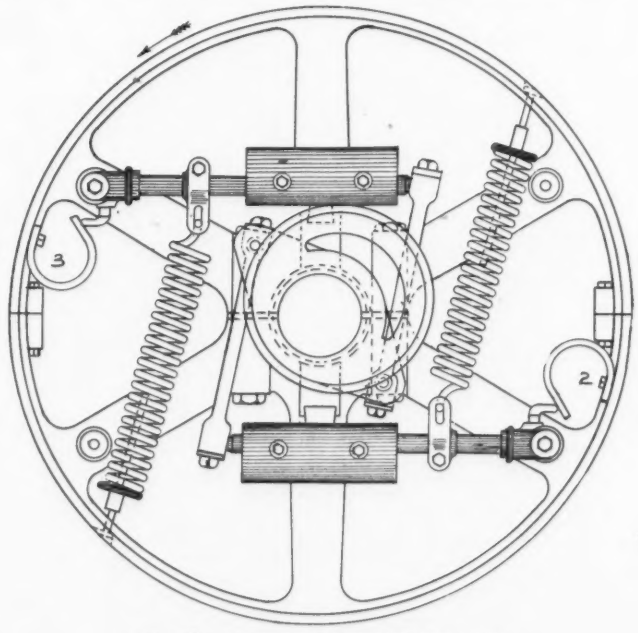


FIG. 16.—BUCKEYE GOVERNOR REVERSED.

6. A peculiar feature of this governor is the pendulum weight, 7, which is pivoted at the extreme end. It is connected by a link to an arm carrying the weight, 2. As 7 stands at right angles to the crank shaft, it resists any tendency to change its speed very strongly on this account, hence it is valuable in maintaining nearly uniform speed under sudden changes of load.

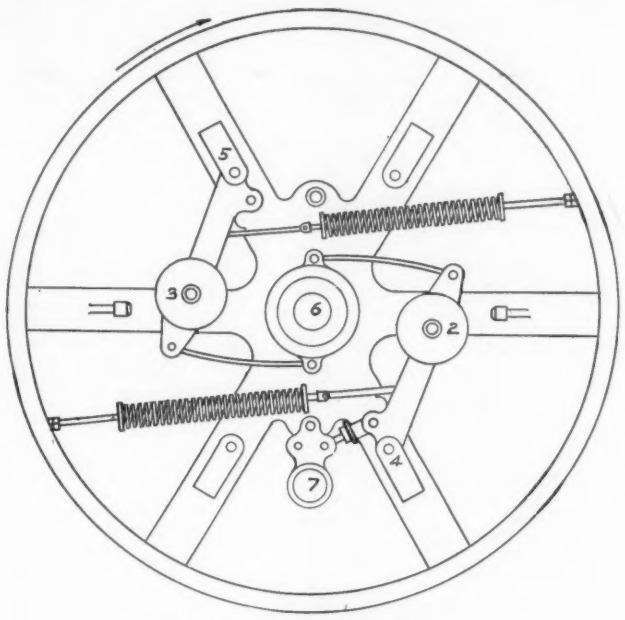


FIG. 17.—CLARK GOVERNOR.

Fig. 18 is the same governor revolving in the opposite direction. Of course all connections are changed, and the pendulum weight is now on the opposite side of the governor.

When reversing this engine or any other on which springs are used care must be taken to give them equal tension as otherwise more strain will be brought to bear on one side than the other, producing unsteady motion, and lack of that perfect balance which denotes correct adjustment. This matter was referred to in connection with engines fitted with a wrist pin on the governor, but it needs to be emphasized when describing those fitted with an eccentric, as the greater revolving surface in contact tends to disturb the balance, thus enlarging the effect of any slightly incorrect adjustment.

Fig. 19 is the Russell engine governor for a right hand engine to run "under" or a left hand "over." The main eccentric is keyed to the shaft, therefore if it is not well lubricated it cannot turn as when held by a set screw. The key way is cut in the shaft, opposite to the crank before the engine is finished in the shop, and it is also cut in the eccentric as nearly correct as possible, but it is sometimes necessary to make an offset key to reduce lead when the engine is tested.

To reverse this engine the main eccentric must be turned, and if an offset key is used it must be reversed. The cut-off eccentric must be carried around on the shaft until it has the same relative position in advance of the crank that it had before. It is necessary to reverse the spring connections and weighted arms to accomplish this. The fulcrum pins for these arms must go into holes at 60 degrees from their former places, bringing the whole into the position shown in Fig. 20. The eccentrics are made in halves to facilitate their removal.

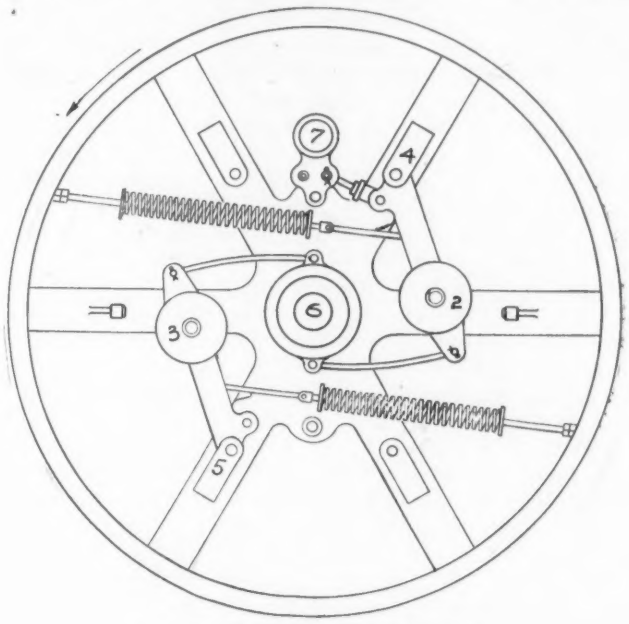


FIG. 18.—CLARK GOVERNOR REVERSED.

In order to get the desired angle of advance for the cut-off eccentric the case containing it must be turned on the shaft until brought to the right place. In cases where the governor is placed in the flywheel, a new key way must be cut, as the wheel must be turned on the shaft.

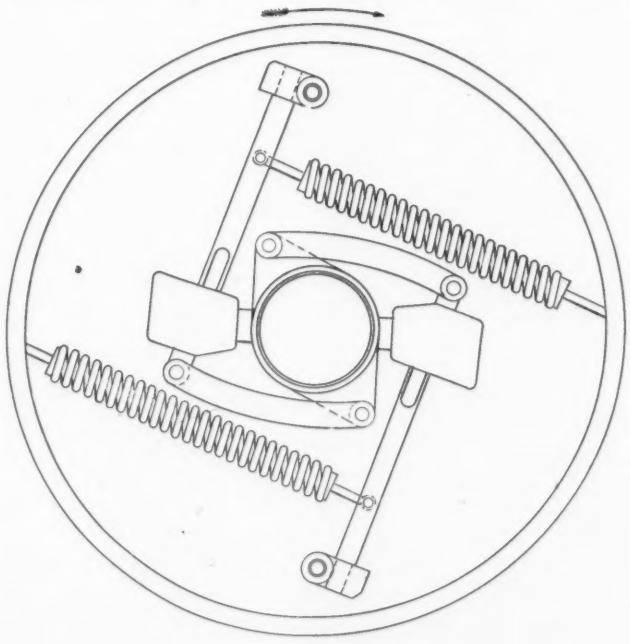


FIG. 19.—RUSSELL GOVERNOR.

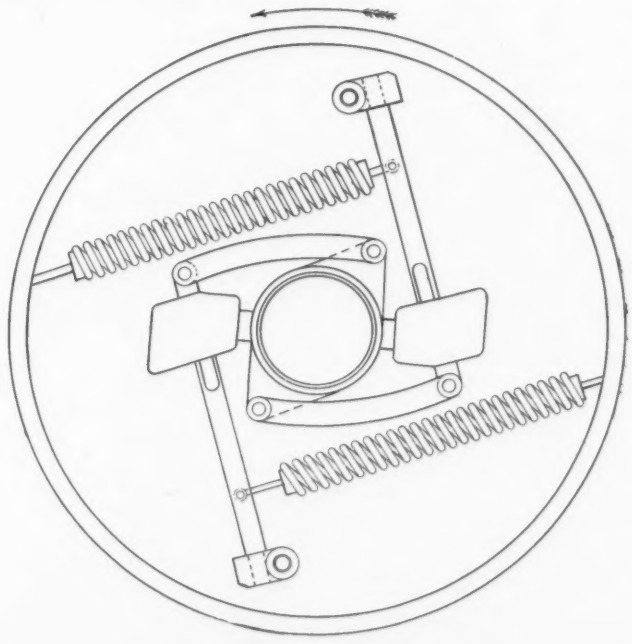


FIG. 20.—RUSSELL GOVERNOR REVERSED.

As shown in these illustrations the weights are in contact with buffers, which they leave as soon as moderate speed develops enough centrifugal force to overcome the action of the helical springs. The arms are slotted to admit of changing the position of weights if more or less centrifugal force is required.

LETTERS ON PRACTICAL SUBJECTS.

THE TESTING OF LIGHTNING ARRESTERS.

With the advent of high-tension transmission lines the subject of lightning arresters seems to have been given increased attention. In the early days of line work and extension the subject of lightning protection was treated, to say the least, in a very perfunctory manner. There was provided an air gap of some kind, a path to earth, possibly a magnet or some such means to extinguish the arc which invariably followed the discharge, and the whole device inadequately insulated and practically certain of destruction in case it had to handle a discharge of any magnitude.

Within the past few years the subject has received a most careful study, for the destruction of a large transformer by lightning is by no means an inexpensive matter, and the presence of extremely long transmission lines throughout the country with such favorable chances of their being struck has given zest to this study upon the outcome of which so much depended.

In common with others, the writer has had frequent occasion to look into this matter and ventures in this communication to set forth certain facts, the recital of which it is believed is justified because of the lack of general appreciation of them and of their paramount importance in lightning-arrester work. No claim of novelty is made or can be rightly made for these.

It is conceded that the function of a lightning arrester is to keep lightning discharges from disturbing the electric system and damaging the machinery, and to fulfill this function it must accomplish three things. First, it must conduct the discharge to earth in a time sufficiently short to render the discharge incapable of affecting or damaging the machinery. Second, it must automatically extinguish the arcs which follow the discharge and which come from a dynamic source. Third, under normal conditions it must not present any leakage path to earth.

Under the very general and popular supposition that electricity is all of one kind, the conditions are somewhat paradoxical. It would seem at first that one could not be obtained except by a sacrifice of performance with respect to the other. The arrester has to handle two kinds of electricity, one of which is the result of a cloud discharge. This is generally conceded to be a condenser discharge, the cloud forming one conductor, the earth the other, and the air the intervening dielectric. It is, therefore. oscillatory, depending for its frequency upon the capacity of the natural condenser and the reactance of the circuits into which it discharges, and in any case the frequency is measured in hundreds of thousands of cycles, and for convenience in what follows the writer chooses to call this an oscillatory discharge rather than a static discharge for the reason that, while static is the more common term, the discharge is emphatically not static, but in rapid motion.

The other kind of electricity which the lightning arrester is called upon to handle and to which it must present an obstructive factor is the dynamic, which proceeds from the generating station. Briefly explained, the lightning arrester must present an almost zero impedance to the oscillatory flow and a breakdown insulation resistance to the dynamic flow a trifle lower than the breakdown insulation resistance of the machine it is designed to protect. This can be accomplished by proportioning the ohmic resistance to break down at the desired figure and making the inductive reactance as low as possible. The oscillatory discharge, backed by the millions of volts of a lightning stroke, cares not at all for a few megohms of ohmic resistance; but the reactance of even a few turns of a kicking coil is generally recognized as an effective block. It is with these principles in mind that a lightning arrester should be designed.

That this is sound reasoning is very prettily exemplified by the time-honored experiment of Mr. Tesla, in which oscillatory current is applied to a single loop of trolley wire, shunted by an ordinary incandescent lamp. The reactance of the loop of trolley wire is so great that the incandescent lamp having many times the resistance of the alternative circuit transmits the major portion of the current and lights in so doing.

For the suppression of the arc which occurs on lightning arresters various means are employed. In the most successful the arc is split up into a large number of small arcs in series, which have a much greater instability than a single large arc. It is endeavored to reduce the heat of all of these little arcs, either by the proximity of large masses of metal with their cooling action, or by causing the arcs to occur between blocks of high resistance carbon, which cut down the magnitude of the current and with it the stability of the arc.

In view of the foregoing considerations it would seem to the writer that a lightning arrester should be tested for its performance by two distinct methods. In other words it should be given a dynamic and an oscillatory test. For the dynamic test the arrester should, obviously, be subjected to a voltage from a source of supply of similar frequency to that on which it is commercially to operate, and its leakage performance having been found satisfactory on the standard voltage on which it is to operate, that voltage should be raised until the arrester breaks down, when it should be immediately lowered to the standard voltage again, to see if the arc is extinguished. The voltage which should be chosen, as that at which the arrester should break down under dynamic stress, should obviously depend upon the conditions obtaining on the line on which it is to operate, due regard being given to the possibility of surges due to the sudden opening of circuits and the like, and a suitable factor of safety being introduced.

Having in this way proportioned the arrester from a satisfactory dynamic standpoint, the oscillatory test should be applied. A very common method is simply to connect the arrester to the terminals of a static machine and shunt it with a micrometer air gap. This test, it seems to the writer, is grossly misleading, for it is plain that, with a static machine of the Toppler-Holtz or Wimshurst type, the pressure at the terminals of the arrester rises until the breakdown point is reached and then snaps across, the discharge being perhaps oscillatory at the time it is snapping across, but the pressure is by no means of an oscillatory character. That this contention has some experimental justification will be found in the fact that if one terminal of the arrester be connected with a Wimshurst machine, and the other terminal connected through a condenser bridged by a spark-gap, very different results will be obtained. The impressed pressure on the arrester will then be of a genuine oscillatory character.

Finally, in comparing lightning arresters it is very common to measure their dynamic impedance by the application of a pressure of the same character as that of the source supplying the line on which the arrester is to operate, and thus to get the breakdown voltage which is used for comparison. A second value is obtained by applying an oscillatory test of some kind and getting the minimum spark gap which the discharge will take in preference to the arrester, and this affords another figure of comparison.

The writer finds that engineers are too prone, in judging of an arrester from the results of these tests, to consider the figures singly; but it is obvious that a fair measure of their qualities can only be obtained by simultaneous consideration. The value of an arrester from a lightning protection standpoint is obviously proportional directly to a function of the breakdown dynamic volts and inversely to a function of the breakdown oscillatory volts, and for want of a better definition of the functions, which have not been sufficiently investigated, the writer has found it convenient to assume that the figure of merit is proportional to the quotient of the two voltages.

It would seem that in selecting a lightning arrester for any given work that it will be well for the engineer to insist on and specify the dynamic breakdown voltage that he desires. This will at once give him a measure of the trouble that he may expect from dynamic causes. Having specified this voltage and secured arresters of different makes, all of which break down at substantially this figure, that arrester which shows a minimum spark-gap on oscillatory test will obviously have a claim to preference from a lightning performance standpoint. But unless the arresters

are alike in dynamic properties, it is reasonably plain that comparison of the oscillatory tests alone will give results which are misleading.

NEW YORK CITY. JOHN HENRY KOHLER.

A MOTOR RUN BY STATIC ELECTRICITY.

When a glass rod is rubbed with a silk cloth it acquires the property of attracting light objects. It is electrically charged with a charge of high tension and small quantity. A stick of

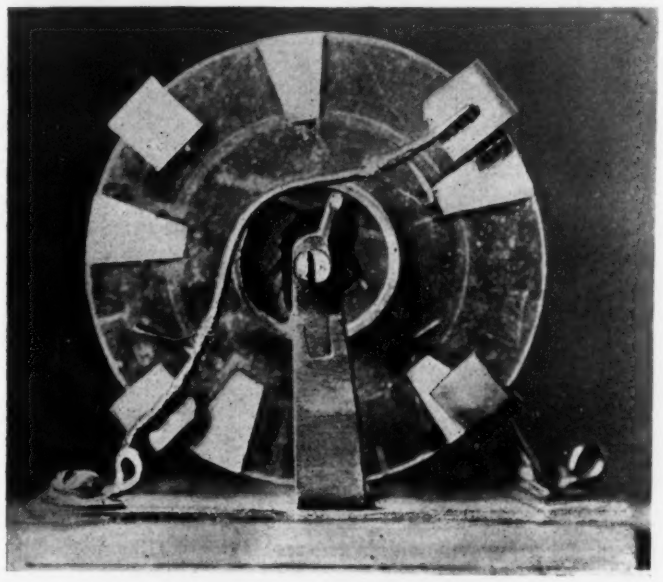


FIG. 1.—END VIEW OF MOTOR.

sealing wax acquires like properties, but on investigation it will be noted that the charges are dissimilar.

If a pith ball be suspended between the glass rod and the sealing wax rod it will oscillate between the rods contacting with each in turn, taking first a positive charge from the one and exchanging it for a negative charge from the other. The pith ball, after taking up a positive charge, for example, swings away from the rod because it is repelled by the like charge of the rod

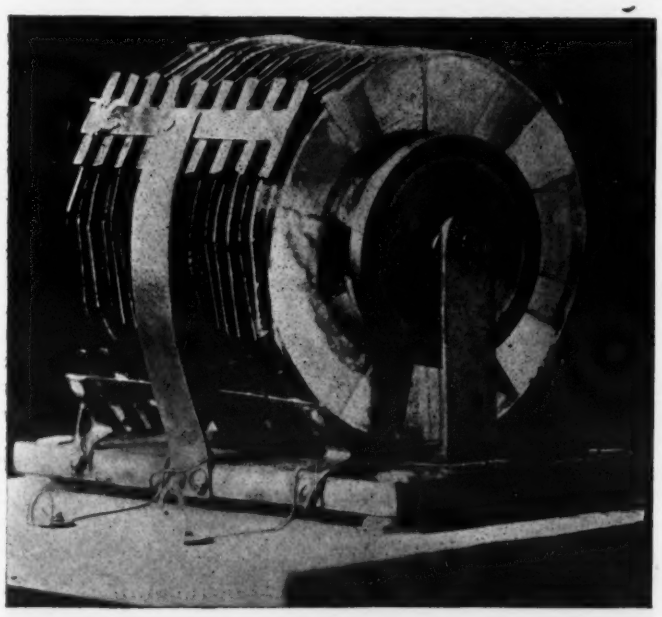


FIG. 2.—FRONT VIEW OF MOTOR.

and, at the same time, it is attracted by the unlike charge on the other rod. So the oscillations continue until the charges on the two rods are again in natural equilibrium.

The machine which is the subject of this paper is based on these phenomena, and in its simplest form consists of a thin glass plate supported on pivotal points and well balanced. This disc has five armature sections of tin foil overlapping the edges of the glass disc, at five equi-distant points. Enveloping the disc, also at equi-distant points, are four field poles, each metallically connected with the field pole diametrically opposite. Each pole has a thin brush mounted thereon which contacts with the armature sections as they pass thereunder. As there are five armature sections and but four field poles, some one of these brushes is always in contact with an armature section.

If, now, one pair of opposite field poles be positively charged and the other pair be negatively charged, then some one of the armature sections receives a charge of like sign with the field pole enveloping it. This armature section is, therefore, immediately repelled and moves away from this field pole and toward the next field pole, to which it is attracted for like reason. As it passes under the brush of this field pole the charge is given up for one of unlike sign and is in turn repelled by the pole. Similar phenomena takes place at each of the other field poles and a continuous rotation of high velocity is maintained.

To increase the torque, a battery of armature plates was mounted on a single shaft, and all the like armature sections in a row (parallel to the shaft) were connected together. But one set of brushes was required. These brushes were arranged to contact with the armature sections only just after each had passed the median line of each field pole. The motor always turns, therefore, in the same direction.

Any suitable source of high-tension current suffices for power, as, for example, an induction machine. A charged glass rod held to one and a sealing-wax rod held to the other of the field terminals are sufficient to cause considerable rotation of a single-plate motor, delicately mounted.

In experiments in wireless telephony a pole supporting wires fifteen feet above the roof of a two-story frame house is used. It was noticed that on the occasion of storms there would be sparking at the gap of a cut-out block on the instrument table. It was found that on connecting the motor between the points, that is, so that one field pole was in metallic communication with the earth and the other with the aerial, the motor would run, beginning some little time before the rain began to fall. It was also noticed that the motor did not always behave similarly; sometimes it would revolve rapidly, while upon the occasion of other storms the torque would be weak.

As the force of attraction and repulsion is in proportion to the capacities of the opposed surfaces, it would seem that a motor of some power might be constructed to run by static current taken from the passing clouds, and this is suggested as a line of research of not unpromising results if the means are at hand for prosecuting it.

WASHINGTON, D. C. C. FRANCIS JENKINS.

INSTALLING NEW ENGINES IN OLD PLANTS.

As the steam engines that drive machinery in our mills and factories become old and badly worn, the consumption of steam is excessive owing to leaks which the engineer cannot stop. Such engines are much more liable to cause delays on account of broken parts than new and improved machines; hence it is really more expensive to keep them in operation than to replace them, but owing to the time that must be lost while taking out the old and putting in the new, which adds much to the total expense of making such a change, the old engine is retained until a more favorable opportunity arrives.

This refers more especially to engines of about 100 hp, which form so large a part of our prime-movers. One manufacturer attempted to solve the problem by making a bargain with an engine builder whereby his old one was to be taken out and the new one installed ready for use between 5 o'clock Saturday night and 7 o'clock Monday morning. This was done, but it introduced another and more vexatious problem, for owing to haste in doing the work the bearings persisted in heating, and the engine taken as a whole made much more noise than another of the same size and kind that had been very carefully installed.

In a case to which my notice has been called within a short time, an engine that has run nearly every working day since it was built in 1858 (except time required to make necessary repairs) is to be still further repaired at a considerable expense.

The owners admit that it is not worth repairing, but business is good, therefore, they cannot stop to put in a new engine.

In another plant the engine has failed five times, causing expensive shut-downs, owing to a design that located the wrist pin on one side of the crosshead the same as a crank pin is on one side of a crank. This has caused the piston rod to be broken five times with the usual result in such cases. Another engine of better design is now being installed, and while this work is progressing a second-hand engine of the vertical enclosed, self-contained type is keeping the machinery in operation.

To make steam enough to run the old engine 10 hours per day used to require 1,600 lb. of hard coal screenings and 600 lb. of soft coal, but the borrowed engine calls for 5,400 lb. of soft coal every day. This is undoubtedly due to bad condition of the valve and piston, but it is a condition and not a theory with which they have to deal, and if an expensive boiler setting is not ruined before the improved engine is ready, both owners and engineer will be pleased and surprised.

The best plan, I think, in such cases, is to install the new engine in another place, and not stop the old one until the new one is ready for use; then by changing the main steam pipe on Sunday, or on a holiday, no time is lost. While this has been done in several cases, proving very satisfactory, it is not always practical owing to local conditions.

Omaha, Neb. Chas. P. Brown.

LOCATION OF BOILERS.

While visiting different plants on business I have noticed that in many of them where 200 hp or less is used the boilers are located in cramped quarters where the light is faint and the ventilation very poor. If steam users fully understood the real cost of such poor management, they would adopt measures to change such conditions where they now exist, and take care to avoid such mistakes in the future. A few illustrations will show what is meant along this line.

In a certain plant a vertical, circular, water-tube boiler was installed, partly because it occupied small floor space. Such boilers require about two stories of head room, which is an objection where one is to be located in a building several stories high, because it occupies floor space on two floors; but this does not seem to be taken into consideration.

In this case the boiler was located near a high building, but not in it, yet for some unaccountable reason the owners had a pit dug about 10 ft. deep, and set the boiler in it. If this had been made large enough to allow sufficient room for the fireman to do his work comfortably, it would be better, but it was not. This furnace has four doors and the wall is so near to three of them that there is not room enough to draw a slice bar straight out without touching the wall. Imagine the discomfort of attempting to clean a fire under such conditions. While I do not wish to judge unfairly still it always seems as if a man who deliberately had such a fire room built did not for a minute fail to remember that it was not for himself to work in.

When these men are asked why they set boilers in such holes they either cannot tell or else say that it was because they wanted to return the water of condensation from heating systems. What an absurd reason this is when we consider that in nearly all such cases steam is reduced to about 5 lb. pressure for heating and the resulting water is pumped into the boilers by a duplex pump.

In the above-mentioned case there is room enough under the engine room floor, between the engine foundation and the foundation walls, to locate a receiver to take all such water, and the pump would raise it 10 or more feet as required for the boiler. This shows that in any case it is only necessary to set the receiver low and not the boiler. The result in practice of this mismanagement is that such portions of the fire as can be reached from doors that have plenty of room around them, are well cleaned, but the others are not, which does not give the best possible economy of fuel. Theoretically, a fireman should clean one part as well as another, and this I do not dispute, but human nature is not constituted on such principles; consequently the average fireman if left to his own devices, will do his best work where he can do it easiest.

In another case a pair of horizontal tubular boilers were located so that in order to scrape the tubes it is necessary to use a rod made in three parts. This is very inconvenient, for under average conditions it will take twice as long to clean a given number of tubes as it will where there is room enough to use a rod made in one piece.

A steam tube blower was purchased and duly connected, but it blew soot into all parts of the building, and as this could not be tolerated it had to be abandoned. For weeks the tubes were not cleaned at all until one day the engineer had to shut down until they were scraped out. Is any reader of this letter so unsophisticated that he believes those tubes are scraped as often as they should be? If so, he had better change his opinion, because they are not.

On account of providing such close quarters for the fireman, it was necessary to put in a direct-connected fan to draw out hot air, and cause a cool breeze to blow on him. Now if those boilers had been set 10 ft. further back it would have been necessary to dig 10 ft. further into a sand bank, and that was all. A good manager would have put laborers at work there as soon as he found how cramped the quarters were, when the boilers were put where the plans located them, removed the sand and set the boilers back far enough to allow plenty of room in front of them.

In another case two horizontal boilers were taken out, and three of the vertical style substituted. No provision was made for unloading a few loads of coal where the fireman can reach it conveniently, consequently he must get it as it is needed from hour to hour. Land is not very valuable in this case, and even if it were there would be no good reason for making the boiler room so small, because every day for years more space in that yard has been lightly covered with scrap iron than would make three such boiler rooms at least.

It pays in a very large majority of cases to provide a roomy and well-ventilated boiler room, but managers are not always convinced of this fact, judging by the above-mentioned cases, which are only samples of many others found in practice.

Buffalo, N. Y. Chas. D. Audley.

SHUTTING DOWN DYNAMOS.

In this city there are many plants where electricity is generated for lighting some part of the works every day, and when the sky is overcast with heavy clouds, many more lamps are wanted. Direct current at 110 volts potential is used in a majority of cases, and the dynamo is nearly always run by a belt transmitting power from a countershaft, so that when the main engine is shut down the dynamo stops.

There is a decided difference of opinion among engineers concerning the proper way to shut down such a plant. Some of them pull out the switches for various lines in regular order from left to right the same as we read lines of type, and then pull out the main switch. When starting up in the morning the dynamo is given full speed, then the main switch is thrown in to connect the pilot lamps on the switchboard, provided there is none directly on the dynamo, then the voltage is built up to the regular working potential of about 112 volts. After these parts are found to be in working order the line switches are thrown in until full load is on.

I favor this plan and use it in my plant, but others adopt an entirely different system (or lack of system), as they pay no attention to the switches, but when it is time to shut down the machinery they close the throttle valve, the engine slacks up and finally stops, causing the lights to grow dim, and then slowly disappear. In the morning they start up without disturbing the switches, the lamps glow when the dynamo is running about one-half speed, and as this is increased they grow brighter until full voltage is secured.

This seems to me to be all wrong, but others say it is right, therefore, I wish to ask readers of your paper to express their opinions on the subject, and give reasons for the plan they favor.

I also wish to ask a question concerning wiring voltmeters.

In some cases the instrument is wired directly to the dynamo: therefore, when the dynamo is started the voltage is indicated before the main switch is thrown in. In others it is wired to the bus-bars; therefore, if the main switch is not thrown in until after the engine is started, the voltmeter remains at zero. Which plan is best, and why?

NEW HAVEN, CONN. J. N. THOMAS.

PROBLEM IN SIGNALING.

I recently had a problem in bell wiring which I think your readers will find interesting. In the accompanying diagram, *a*, *b* and *c* represent office rooms. It is desired to have a system of bell and buzzer signals so that signals could be sent from any room to any other room in such a manner that it would be known whence the signal came. The distance between *a* and

PROBLEM IN SIGNALING.

b is thirty feet, and the distance between either *b* and *c*, or *a* and *c* is eighty feet. The battery may be located where desired, but only ordinary push buttons, bells and buzzers can be used. It is desired to accomplish the result in a practical way and with the least amount of wire.

WHITTIER, CAL. C. E. COOK.

LOCATING TROUBLE IN A SINGLE-PHASE MOTOR.

I recently came across a case of trouble in a single-phase motor which, while very simple to those familiar with such motors, proved a great puzzler to the central station man in the small town where it was installed, and may prove a similar puzzle to others who have never had much experience with this motor. This motor is provided with an automatic governor device which short-circuits a certain amount of resistance contained in the armatures. This short-circuiting takes place when the armature is nearly up to speed. The motor in question would not get up sufficient speed for the automatic cut-out to act. It would consequently drag along with the resistance in circuit and the armature or rotor would get very hot. The motor was taken apart and the armature sent to a neighboring large city for repairs. When it came back nothing had been done to it save the resoldering of a few leads. It was put back in the motor and the motor was found to operate the same as before. This type of single-phase motor has a condenser enclosed in a case in the base of the motor, which condenser is connected in shunt with certain of the stationary windings in order to produce a current leading slightly in phase that of the other windings on the motor and so obtain a rotating field. It was suggested that a good place to look for trouble would be in this condenser. The condenser was accordingly disconnected and a magneto test applied to its terminals to determine whether some of the plates might not be short circuited. The magneto rang upon the test, seeming to indicate a short circuit; but lest the capacity of the condenser might be sufficient to allow the magneto to ring even though there were no actual circuit through the condenser, another test was made with an incandescent lamp in series and it was found that the condenser was fully short-circuited. The condenser was then taken out of its case and the slabs of which the condenser is made up were disconnected and tested one by one until a slab was found in which a short circuit existed. Upon taking this slab out, the puncture was readily found, as the condenser had the appearance of having had a nail partially driven into it at that point, this appearance, however, being due entirely to the electric discharge between the condenser plates. The condenser was again connected up to the motor with the defective slab out of circuit and the motor operated up to speed as well as ever. It should be remembered in testing condensers for short circuits that their capacity is sufficient to allow a magneto to ring even when there is no short circuit in them. This was fully demonstrated in testing up this condenser after the short circuited part had been removed.

CHICAGO, ILL. CHARLES T. STOWE.

RESISTANCE REQUIRED FOR MOTOR STARTING BOXES.

The calculation of the various steps for the resistance of a motor starting box is divided into two parts; one, the determination of the resistance in ohms necessary to produce a regular series of steps, and the other the calculation of the diameter and length of wire necessary to carry the respective currents without too much overheating. The conditions to be complied with are generally that the current passing through the switch on the first stop or contact must not exceed a certain amount, and that when any succeeding sections are cut out the current must not increase to more than that amount. Another condition is that the number of contacts must not be less than a given amount and the first condition naturally involves such a minimum. Up to the point at which the motor starts to run the calculation of the required resistance is merely an application of Ohm's law; that is, it is the quotient of the line voltage divided by the current which is allowed to pass. Unless there is a specification to the contrary, it is advisable to assume that the motor has to start with a full load, and in that case it will not start unless it receives the full-load current. When the armature begins to move it generates a counter e.m.f. which tends to cut down the current, and as soon as the switch-arm is moved to the next contact, there is a sudden rise again. The various resistances should evidently be so proportioned that the rise and fall of the current shall take place over the same range for each contact point, assuming that the switch remains long enough in each position for the armature to run its full speed for that resistance. To fulfill this condition the resistance must be in a descending geometrical progression. The value of the resistance from the point where the motor starts is known, and the resistance in circuit for the last contact is that of the armature only.

All that is required therefore is to insert a number of geometrical means between these two extremes, and this can be done very easily by means of the slide rule. To do this, find the two extreme values on the scale of the slide rule and then on a strip of paper divide the length between them into a number of equal parts, one more than the required number of means, and then read off the values at each division which will give the required resistances. After having found these resistances it is necessary to calculate the length and diameter of the wire, which is done by means of the well known formula that for a given rise of temperature the current is equal to a constant multiplied by the square root of the cube of the diameter the constant measured depending on the material and on the temperature, as also on the ventilation of the box, etc. It is however not possible to give more than approximate values for this factor which are as follows: For German silver, from 1,000 to 1,500; platinoid, 800 to 1,300; Eureka, 700 to 1,100; tinned iron wire, about 1,100 to 2,000.

MILWAUKEE, WIS. C. NOTTER.

CHANGING POLES ON 33,000-VOLT LINES.

Although working on live high-tension lines of over 10,000 volts is not advocated by some engineers, it is a practice that of necessity is commonly followed in southern California, where poles are frequently renewed on a 33,000-volt transmission line without interrupting service on the line. It should be explained, however, that the line is in duplicate, two three-phase circuits being placed on a single pole line. Either one of these circuits can be used alone to carry the load, so that actual handling of 33,000-volt live wires is not necessary. When a pole on this line becomes so badly burned that it is necessary to replace it, the procedure is something as follows: One of the three-phase lines which is located on one side of the pole is disconnected at the substations and as a precaution a short circulating chain is placed over this line by the lineman at the

point where work is being done. The "dead" line is then unfastened from the insulators. Dirt is removed from around the bottom of the pole and the pole with the live line tied on it is pulled over to one side as far as practicable. A new post hole is dug close beside the old pole. The new pole is then raised, its top being carefully passed up between the live and dead lines with its cross arms parallel to the lines. The pole is then turned around into proper position, set, and the dead lines tied to the insulators on that side of the pole. The short circuit on the dead line is removed and word is sent to the chief operator to change the load from one line to the other, thus putting in service the line that is tied to the new pole and leaving the other line which is tied to the old pole dead. The dead line is then unfastened from the insulators on the old pole and tied to the insulators on the new pole. Of course, this all requires very careful work. The substation operators the whole length of the long transmission line must be absolutely depended upon to carry out instructions and to report correctly what they have done when lines are being changed over. While the short circuiting chain is somewhat of a check against mistakes by substation operators, after once the line is cut out, it is no laughing matter to attempt to short-circuit a 33,000-volt line which is supposed to be dead.

Redlands, Cal. James L. Rand.

GAUGING CONDENSER WATER PIPES.

In many of the Southern cities, despite all the precautions that are taken to keep out material and growths from condenser intakes through strainers, screens, etc., the suction draws up many barnacle spawn and spats which attach themselves to the inside of the condenser intake and build up their shells. These in time form a hard, crustaceous lining which unless watched gradually reduces the diameter of the pipe and thus the quantity of water supplied to the condenser. In this city the electric light company makes periodic inspections of the condenser water-pipes to determine how much of a growth there is and whether or not there is any danger of diminished water supply to the condenser. Thin copper balls are inserted in the intake and these are drawn up through the pipe by the force of the water. A small ball is used at first and larger ones in succession. At the condenser end the balls are taken out and examined. When the marks on the larger balls show traces of much scratching, it is taken as evidence that the incrustations in the pipe have reached a certain thickness. The diameter of the largest ball passed through is taken as the minimum diameter of the opening through the pipe and in this way the condition of the pipe is noted from time to time.

Galveston, Texas. F. S. Lent.

MOTOR AND DYNAMO TROUBLES.

It is oftentimes instructive to note the failures of electrical machinery from all causes and thus to obtain a knowledge of where the machinery is weakest so as to guard against possible breakdown at such places. The writer, out of curiosity, kept in a note book an account of all the failures which he came across and was surprised at the results, and also at the frequency with which certain causes of breakdown presented themselves in machines of almost every make. The observations were made on all kinds of dynamos and motors ranging from the smallest commercial machine built to fairly large generators having capacities of 500 to 750 kilowatts. More trouble is found in the armatures than anywhere else, while commutators make a close second. The mechanical parts come next, followed by field magnet and brush gears. Where field coils are damaged the chief fault is that the insulation breaks down between the coils and the core. Arcing from the series coil to the shunt coil on the same pole piece is not infrequent and is more prevalent in bipolar machines than in others. In these machines the coils often touch and unless the outer layers are at the same potential the risk of accident is considerable. Armature faults are mostly due to the burning out of coils. Oftentimes the entire armature is burned out while at other times only a coil or two has gone. The number of failures due to the grounding of armatures is not small by any means, and most of these are due to defective insulation. Dust, grease, etc., on the insulating ridges, at the outer end of the slot insulation or at the end of the coil supports of a barrel-wound armature, made up the greater part of the rest. Breaks in the wire are more prevalent in the smaller sizes of wire-wound armatures and usually take place where the wires leave the coils or join the commutator. Fusing of the binding wires by arcs between the binders and armature conductors are of rare occurrence.

The failures of commutator insulation usually occur at the ends, causing leakage to the earth-connection portions of the commutator or between bars or radial connections. In the majority of cases these failures are caused by the presence of dirt on the insulating ridges or between the radial connections. Commutators also frequently fail because of purely mechanical reasons. The commutators burst, the lugs may be fractured, or the keying of the commutator may fail. Where surface fusion of the commutator has occurred it may usually be traced to the destroyed surface of the commutator due to violent sparking. The breakage of shafts is more common than would be imagined. The armatures usually get out of center because of the wear in the bearings and the unbalanced downward magnetic pull added to the weight of the armature serves to produce a bending moment in the shaft. The bearings sometimes wear upwards. This occurs when the armature has been placed nearer the top of the race than the bottom in order that the upward pull of the magnets may relieve the pressure on the bearings. When this upward pull is greater than the pull of gravity, the bearings wear upwards and permit the armature core to approach the pole-tips when working. This is a dangerous defect owing to its liability to escape detection. Where commutators fail because of the insulation this failure usually occurs between the bars and the supporting rings, the parts subjected to the greatest difference of potential. These breakdowns often result in the burning out of the armature windings. Less in extent is the breakdown of the insulation between the segments of the commutator. This seldom results in more than a few coils being damaged and only in rare cases does the break occur in the body of the insulation, permitting flashing through it. Where these cases have occurred it is usually due to the substitution of some material which absorbs moisture, for mica. Nearly all the troubles with the commutator insulation are due to the collection of oil, dust, etc., on the insulating ridges separating the segments from the clamping nuts. In many cases the ridges are too short, while in others there are no ridges at all, the insulation being flush or sunk below the level of both bars and rings. The insulation at the outside end is usually most exposed to such accumulations; but being more easily cleaned fewer breakdowns seem to occur here than at the back end. Sometimes the commutator wedging arrangements slack back and permit chattering resulting in the pulverizing of the insulation.

The bursting of commutators owing to centrifugal force is not very common and where they do occur it is because of improper locking arrangements. Sometimes the bars are allowed to wear down too far and the commutators burst. Where the keying is defective the commutator is driven by the armature wires, and sometimes the commutator and the armature have a slight relative motion on the shaft. This causes the breaking of the wires joining the armature to the commutator. Faults in motor starting boxes are also the cause of a number of burnt armatures. The breakage of the wire in the starting box near the last stop subjects the armature to very heavy starting currents by applying directly the full voltage of the system to a standing armature. In shunt motor starting boxes a common fault consists in taking the connection from the last stop to the resistance. This results in the voltage applied to the shunt at the moment of switching on being lowered to the same extent as the voltage applied to the armature, with the result that to get the necessary starting torque the full load current has to be much exceeded. The starting torque can be kept up by attaching the shunt wire to the first stop in the resistance. When the switch is in the "on" position the current from the shunt is required to flow back in the resistance; but as a general rule this is a matter of little importance.

Brooklyn, N. Y. C. T. James.

QUESTIONS AND ANSWERS.

We have two 250-volt direct-current compound-wound generators, one of 45-kw capacity and the other of 18-kw capacity, which we desire to run in parallel. They are now working in parallel after a fashion, the smaller machine taking almost all of the load. How can the machines be made to divide the load more evenly. A. S. M. M. Co.

Add a resistance externally to, and in series with, the series coil of the machine which has a tendency to take more than its share of the load.

What effect have scum and dirt on the speed of an induction motor having a squirrel cage armature? C. B. McC.

The presence of scum and dirt on any type of electrical machinery does not betray great care on the part of the attendant. While it may not affect an induction motor of the type mentioned as much as it would a direct-current motor, the presence of either should not be tolerated as both are inimical to the well being of any electrical apparatus.

Which is the more suitable for raising and lowering arc lamps, hemp rope, cotton rope, or wire cable? S. V.

Many of the electric light companies prefer wire rope with a hemp core owing to its combined strength and flexibility. This has a tendency to rust, however, and to present a bad appearance. There has lately been placed on the market a heavily galvanized chain which is as flexible as heavy window chain and possibly stronger. We should imagine that this would be more serviceable and better looking than either rope or cable.

When installing transformers for delta connection upon three-phase circuits is there any particular rule to be regarded? A. B.

When transformers are installed as stated care should be taken that the connections are made in such a manner that in case of accident to any one of the transformers, mechanical and electrical changes can be quickly made whereby the motor may be operated from the remaining transformers. This point is of great importance if continuous operation is to be assured, but unfortunately it is often neglected.

We are operating motors and incandescent lamps from the same transformers, but find that the regulation is very unsatisfactory. Is there any way of improving the regulation on the lamps? H. N.

It is advisable to use separate transformers for the motor circuits, because of the fact that a variable load upon the motor introduces a lower regulation in the transformer than is desirable for the operation of incandescent lamps. Where the latter are supplied from a separate bank of transformers much better regulation is obtained, even though the primaries of both the motor and lighting transformers be connected to the same mains.

Why are the brushes of a four-pole dynamo placed 90 deg. apart instead of 180 deg.? R. P. F.

Because of the arrangement of the winding. There are two distinct generating circuits in a four-pole machine, one corresponding to one pair of adjacent poles and the other to the other pair of poles. As in the case of a bipolar machine, the position of the brushes for each circuit is between the poles, which brings the brushes 90 deg. apart. Instead, however, of using four brushes, the two circuits are sometimes connected in parallel, thus reducing the brushes to two.

Will you kindly inform me what size and how much iron wire must be used on a motor-starter for regulating the speed of a 5-hp, 200-volt shunt-wound motor? C. W. H.

The starting box should have a total resistance of about 48 ohms. This should be divided among 10 contacts whose resistance should be about as follows: 10, 7.35, 6.6, 5.85, 5.20, 4.35, 3.60, 2.85, 2, 0.5. The size and amount of the wire will depend upon whether you wish to use the box for merely starting the motor, or whether you wish to be able to run continuously on any contact. In the former case a smaller wire will be required than in the latter, inasmuch as with the latter arrangement the wire must be sufficiently large to carry the current without serious heating.

We have a motor which has been giving a great deal of trouble and which we are unable to remedy. There are just four segments in the commutator which blacken and cause the brushes to spark badly. We have tested the armature with a milliammeter for loose leads and short circuits, but can find nothing. Thinking that perhaps the armature was out of balance we had it taken out and balanced, but this did not help as it gives as much trouble as before. We have spaced brushes so they are set correctly. The belt that runs on this motor is of rubberoid laced with wire. How can this trouble be remedied? C., M. & St. P. R. Co.

We have frequently had this trouble called to our attention; but unfortunately the data given are insufficient. Unless the number of field-magnet poles, the number of coils on each pole, the number of sets of brushes and how these are spaced are given it is useless even to hazard a guess. If the blackened bars are not equally spaced around the commutator the trouble may be due to India mica which should never be used in commutators, as it is too hard.

In the issue of the ELECTRICAL WORLD AND ENGINEER dated December 18, 1905, is an editorial on a new frequency meter in which it is stated that the operation depends on the well-known fact that the alternating-current strength which will flow through a given condenser under a given impressed voltage, increases directly with the frequency. Thus at 2,653 volts a one microfarad condenser will take one ampere of current, if the frequency be just 60 cycles per second; whereas if the frequency is doubled and the voltage unchanged in magnitude, the current in the condenser will be two amperes. On page 1,029 mention is made of the fact that if an alternating (sinusoidal) e.m.f. of E volts and frequency f is impressed upon a condenser of capacity C farads, the current may be expressed in amperes as $2\pi f E C$. Should this read as it does, or should it read a condenser of C microfarades? With a condenser of 2 microfarads capacity, what current would flow through the same under an impressed e.m.f. of 110 volts, the frequency of the circuit being 60 cycles per second?

The formula $I = 2\pi f E C$ is correct. The capacity of condensers is always measured in microfarads (0.000001 farad), as the farad is too enormous in value for practical purposes. The solution of the problem proposed is as follows, the denominator representing the ratio of microfarads to farads:

$$I = \frac{2 \times 3.1416 \times 110 \times 2}{10^6} = .001382 \ amp.$$

Why is it that a pump cannot be made to draw hot water satisfactorily? J. G. B.

If the pump is placed below the level of the water supply so that the water will flow to the pump under pressure and thus hug the piston on the suction side, the pump should work well. If this does not obtain, difficulty will always be encountered. The reason for this is that when the piston moves forward it causes a reduction of the pressure on the suction side. Now it is known that water will boil and give off vapor at a lower temperature if the pressure is reduced below that of the atmosphere. The piston will therefore run away from the water, so to speak, and the partial vacuum thus created will fill with steam and thus reduce the capacity of the pump. When the piston returns, there being no solid water to contend with, the steam is compressed and comes up against the water with a shock sometimes sufficient to damage the pump, but more often leading to its erratic action. With small valve openings and high piston speed the trouble is much aggravated. Sometimes a tee in the suction pipe higher up than the supply in the heater is used to allow the vapor to escape.

In making the positive plates of a storage battery, what composes the active material and what proportions are used in the mixture? What is the mixture used on the negative plates? W. A. J.

The material applied to the positive plates of a storage battery is usually composed of a mixture of minium, or red lead, with a slight admixture of litharge. This mixture of oxide is moistened with a solution of ammonium sulphate and while it is in a plastic condition the grid is filled until the material stands flush or a trifle above the edge of the rectangular frame. The grid and its contents are then subjected to pressure between some layers of absorbent material to remove the excess moisture and to further compress the material. The material used for filling the negative grid consists of a mixture of litharge with a slight addition of red lead. In this case the mixture is moistened with a very dilute solution of sulphuric acid. The grid is filled and compressed in much the same manner as the positive grid. When all the elements are completed and connected direct current is passed through the battery until all the material on the positive plates has been converted to peroxide and all the material on the negative has been reduced to metallic lead. During the process of formation it is preferable to use a very dilute solution of sulphuric acid, much lower in strength than the regular electrolyte, in order to avoid as far as possible the sulphating of the material, which if allowed to occur delays the formation. Complete formation is indicated by the color of the plates; dark brown for the positives, and gray for the negatives.

CENTRAL STATION SALE OF CURRENT

What Is Good Advertising?

By Frank B. Rae, Jr.

IN one of the oldest American magazines of publicity—a magazine well along toward its sixteenth volume—there recently raged a heated controversy under the caption, "What Is Good Copy?" The incident is mentioned because already in the central station field we find the same question raised—a question as old as advertising itself, and one to which there is no final answer. Most of us can recognize good copy when we see it—we often pause to admire the logic, the English, the typographical excellence of such advertisements. But an analysis of even a hundred specimens which appeal to the average man as virile and convincing will fail to reveal any substantial basis for making judgment. Good advertising, like other good writing, must contain something more than the rhetoric book teaches. It must have charm, logic, personality and individuality, and that individuality must be at once magnetic and convincing.

Advertising, when all is said, is simply sales talk. The talk which sells the goods is good advertising—that which doesn't, isn't. And the prospective customer is the judge. It follows, then, that the only viewpoint from which advertising can be rightly criticised, is the viewpoint of the customer—of the public. "Put yourself in the other fellow's place," is the first rule of the successful advertising writer, and this rule may be said to embody the sum total of advertising advice.

It is not always an easy matter to do this. The technicalities of the electric lighting business, the thought habits of years, the prevailing customs and precedents by which we are all more or less bound, make it difficult, if not utterly impossible, for us to attain an antipodal point of view. To entirely lay aside the cloak of knowledge which our years and experience have wrapped about us, to divest ourselves of all prejudice and look calmly at our own proposition with the same disinterested coldness with which we would examine a gold brick, is a feat of mental gymnastics which few men can accomplish. Yet it is essential to all who would write good advertising.

Electrical men are over-prone to magnify the technicalities of their profession. They are so wrapped in the more abstruse engineering details of their daily problems that commonplace and elementary points of central station practice which would interest the public in electric service are passed over as trivial or self-evident; and when these same points are suggested by an outside "ad" man they rise to protest against the introduction of "yellow advertising."

An incident will explain: An advertising man with a fair working knowledge of central station conditions and ethics was recently confronted with the problem of booming one of two companies operating in the same territory in competition. The "ad" man's client had several stations connected by tie lines and protected by a storage battery. The competitive company had but a single station, no battery and hard luck—which combination had several times resulted in more or less serious and, to its customers, annoying interruptions of its service. In his literature the "ad" man dwelt at length and with enthusiasm upon the tie lines which protected his client's customers from similar trouble, and in the exuberance of his argument employed the word "amazing" as a qualifying adjective. He appreciated the humor of the "amazing" statement regarding tie lines, viewed from the technical standpoint; but he knew that, to the man on the street—the man who is so ignorant of things electrical that he thinks he is wasting electricity when he turns the button of an empty lamp socket and allows the "juice" to escape into the air—this talk on tie lines would be accepted as being in the nature of a revelation.

To the technical man it was the sheerest nonsense. To him the necessity for and presence of tie lines were such obvious and elemental facts, that he could see no virtue in exploiting them at all, much less characterizing them as "amazing." He claimed, and justly, that even a popular exposition of the point should correspond as to accuracy with the strictly scientific facts. He deplored the introduction of circus methods; characterized the statement as bordering upon "yellow advertising," and finally, he feared that a reaction would result when the deceived public should realize that tie lines are as common in their way as insulating tape.

The incident is enlarged upon here, not to justify the use of a questionable adjective upon the part of the advertiser, but as showing the divergence of the two views; that of the "ad" man studying the situation from the public's standpoint, and with utter disregard for a scientific exactitude which would weaken his argument regarding the reliability of the service; and the natural unwillingness of the technician to sink to the level of common understanding in discussing his specialty with common people. To talk popularly does not mean to talk inaccurately, but it does mean that one should search out and enlarge upon whatever points of commonplaceness will most strongly appeal to the imagination, even the ignorance of the non-technical public, and convince one of the merits and value of your product. This is "putting yourself in the other fellow's place." The talk on tie lines may have had a tinge of "yellow"; it may have gone against the grain of the superior intelligence of the engineer, but it convinced the public of the dependability of the source of supply and sold the goods in the face of unreliable competition. That is the final test.

It is not to be understood that exaggeration or spectacular endeavors are advocated in dealing with the public. On the contrary, the very nature of good advertising demands that the central station proposition be presented in brief, sensible and coherent fashion; that it be advocated soberly and earnestly. The transaction of business is a serious affair with most men, and the object of advertising is pre-eminently to transact business or lead up to it. When a man is considering the use of electric energy for light or power, he weighs your product against its various competitors. In the scales of his decision you must throw valid reasons, convincing arguments.

But these reasons and arguments must be valid and convincing from *his* standpoint, not yours. He is studying his own private problem from his own personal point of view. He is interested not at all in you or your arguments unless they are advanced from the same viewpoint. In his excusable egotism he ignores the strongest technical reasoning and demands statements which his ignorance will comprehend. In the case of the "amazing" tie lines he had previously been assured that interruptions of service were inevitable and that he must put up with them. To make him understand that this was not so, it became necessary to make a vivid appeal to his imagination *from his own standpoint.* And to have calmly stated the cold, technical truth, would be to lose all force of the argument from that standpoint. That far, exaggeration is not only permissible; it is essential, even at the expense of outraged technicalities.

But to err on the other side is almost as bad. One can miss the bull's eye as far by shooting under the mark as over. Palpable absurdities, jingles and jests, catchy pictures and clever novelties, may induce a man to gamble a nickel for a patent ginger-snap, but they will not influence his judgment in a matter so serious as the adoption of electric light or power. The exaggeration of the commonplace, if it be *too* commonplace, or *too* exaggerated, may very easily insult your man's intelligence. The public must not be given credit for knowing anything of the technicalities of electric science nor the secrets of central station practice, but be assured that the average American is not lacking in good, common horse sense.

The gravest of all advertising errors is that represented by the first Omega Oil announcements—a foolish picture with no connection to the product advertised. Unfortunately, for those of us who are striving for results of a practical nature, this form of abortive advertising is already finding its way into the electrical field. It may appear as a picture card, newspaper cut,

folder or what not, but its characteristics are the same—a frenzied and generally futile effort after cleverness; a straining for startling effect in word or picture. Such a form of publicity is not advertising. It is uninspired idiocy. The stuff may catch the eye, may provoke a smile, may cause a certain amount of stir and comment among the unthinking, but it does not bring desirable customers on the circuit.

The question, "What Is Good Advertising?" is impossible of direct answer, but something like a solution may be gained by the writer who will "put himself in the other fellow's place," reason with the "other fellow" in non-technical phraseology; in short, who will prepare or cause to be prepared advertisements which fulfill the condition laid down by general advertisers of wide experience, and which may be stated about as follows:

1. A prominent head line, germane to the subject, set in good, readable type.

2. One, two or three of the strongest features of the application of electric current which is being advertised, presented in plain, ordinary, commonsense style, with short words and crisp sentences.

3. An illustration that shall be technically accurate and possess "human interest" by showing people in their natural positions in relation to the electric appliance pictured, whether it be lamp, motor or other appliance.

4. An invitation to those whose interest has been aroused, to ask by 'phone or letter for additional information touching their especial needs.

What Constitutes Good Central Station Advertising.

BY M. S. SEELMAN, JR.

When I read in the ELECTRICAL WORLD of July 7 the article by Frank B. Rae, Jr., on "The Advertising Exhibition at Atlantic City," I was at first somewhat nettled and tempted to exclaim, with Cassius:

> "Now, in the name of all the gods at once,
> Upon what meat doth this our Cæsar feed,
> That he is grown so great?"

But then my sense of humor asserted itself, and before I took the article in question seriously I determined to write and ask you as to who this Frank B. Rae, Jr., is, and in recognition of what equipment, experience, services and standing is he entitled to a wide hearing for the individual opinion in which he sweepingly characterizes as worthless, the advertising that has been done and is being done by the central stations in the big cities, and with one fell back-handed stroke wipes it clean off the map of profitable publicity?

I "manage" the advertising of one of the "seven large companies," which Mr. Rae speaks of as having shown a "flash" at Atlantic City, and I want to say that so far from my department being run with "the wastefulness, the inefficiency, the purse-proud disregard for economy and conservatism," which he says "has marked the advertising of metropolitan lighting companies," it is run with the most careful regard for economy, not of the penny-wise, pound-foolish variety, but of the real, genuine kind. We do not believe in spoiling the ship for a ha'porth of tar, but we take no step until we have carefully planned and considered it in all its bearings and worked it out, so far as possible, in all its details, including expense and probable proportionate effectiveness. That the sum thus annually expended is a large one signifies nothing. We are not advertising a peanut stand. Our appeal is to a constituency of a million and a half of people. The company is a large one, the business advertised is extensive, and the results are proportionate to the amount expended.

I do not agree with Mr. Rae's implication that all managers of large central stations are idiots with plenty of money to spend and no brains to direct its expenditure. My observation and experience lead me to the conclusion that nowhere is expenditure more carefully tabulated, watched and regulated than in the big central stations. I have no reason to believe that conditions are radically different in other companies from what they are in that with which I have the good fortune to be associated, where the manager is awake—wide awake—and alive to his finger tips. Not only is the expense for each feature of the advertising work—the bulletin, newspaper advertising, circulars and pamphlets, follow-up systems, salaries, etc.—worked out, compared month by month and regulated in accordance with conditions and results, but the entire cost of advertising per 16-cp lamp equivalent of net new business secured, is also carefully followed and regulated. The incompetent or extravagant advertising man would have small chance of surviving beyond the second or third moon. He would have short shrift of it.

Mr. Rae remarks that "The advertising shown in connection with the N. E. L. A. Convention *looked* good. But was it?" and he then modestly answers his own query by conservatively declaring "I venture the opinion that it was not advertising at all." Here is where Mr. Rae pays his respects to me for the exhibit of my advertising, which is pictured in the largest illustration that accompanies Mr. Rae's article, is naturally included in this pleasingly discriminating characterization.

Well, it may not be advertising, but it has sold the goods, and my test and understanding of a good advertisement has always been the advertisement that *does* sell the goods. The only one real point in Mr. Rae's article with which I agree is that cleverness is not essential to a successful advertisement. A good advertisement must, according to my idea of it, attract the attention and hold that attention until its lesson is driven home, turning attention to interest, interest to desire, and, in the very best advertising, desire into resolve to buy.

There are, I believe, but two kinds of, or classifications for, successful central station advertising. The one, is general educative advertising designed to inform the public as to the advantages and conveniences of an electric service and make them "hanker" after it; the other, is advertising of specific propositions inviting direct returns. Both these varieties demand the active co-operation of the sales department in order that the most effective and comprehensive results may be secured. Both are necessary and if done with intelligence and direction both are profitable.

As for the pretty pictures exhibited at the convention, Mr. Rae is probably not aware that Mr. Martin, chairman of the N. E. L. Association's Committee on Advertising Exhibit, in writing to the large central station managers asking their co-operation, particularly requested that sketches of this kind be sent, so as to give a touch of art and color to the exhibit. Mr. Rae is also seemingly unaware that in an exhibit like that of Atlantic City it is impossible to adequately enunciate the logic or illustrate the process of any comprehensive system of advertising, which may include not only the production of various consecutive and co-related advertisements, distributed by different methods and in varying channels, but the contemporary and properly directed effort, in co-operation with an entire sales force. The best that can be done for such an exhibit is to show samples of what Mr. Rae terms "pictures and printing."

Yet, if Mr. Rae, instead of casting the contemptuous glance of withering scorn at the Atlantic City exhibit, en masse, had studied it a little in detail, he would have found examples of "pictures and printing" which indicated campaigns intelligently conceived, "based"—to use his own formula—"upon substantial and logical reasoning, not upon guesswork," "material written with another end in view than that of tickling the advertising writer's vanity," and with "embellishments designed with a view to a precise psychological effect upon the recipient"; campaigns that have been conducted economically and not with "purse-proud disregard, etc.", and which have accomplished the results contemplated, in the cheapest way and in the quickest time.

For instance, there was a recent little electric fan "campaign" indicated in the Brooklyn exhibit—a "Winter Sale of Electric Fans." The "campaign" consisted of a small folder, two typewritten circular letters and a special return post card. Six thousand of each of the first three—the folder and the two letters—were distributed at intervals to the same six thousand addresses. In each piece of this matter sent out, one of the post cards was enclosed, making all told 18,000 post cards. The entire printing

bill for this campaign footed up to less than the wildly extravagant sum of $75. Within six weeks (not of the hot weather fan season, but prior to it, in the spring) as a direct result of this advertising and wholly by means of orders on these return post cards, more than 1,300 fans were sold, a number considerably in excess of the supply purchased.

This is only mentioned as one small instance of practical, economical and successful special proposition advertising. A score of such, many far more comprehensive than the one outlined, could be cited if space permitted. But this one is enough to indicate what Mr. Rae did not see at Atlantic City, and to illustrate his lack of information on the subject which he assumes to discuss as from a standpoint of complete knowledge and superior intelligence.

Organization and Conduct of a New Business Department, Suitable for Central Stations in Cities of 50,000 Population and Under.*

By S. M. Kennedy.

THERE is probably no other kind of business in America to-day which is capable of as much development as is the selling of electric energy. At first glance, this may appear to be a bold assertion, but the more the subject is considered, the more the truth of the statement will become evident. There are countless opportunities for working fields only partially cultivated, for plowing and sowing fields now lying fallow, and for reaching out into the deserts and making them "blossom like the rose." It matters little what may be the relative size of the city in which a central station is being operated—whether it contain 5,000, 50,000 or 500,000 population, the opportunities are there in each case and almost begging to be looked after. However, opportunities are not in the habit of rushing at those who sit down and wait for them; they require to be sought. But many a man who is sincerely looking for opportunity will be surprised to find that opportunity has been looking for him, and anxious to meet him more than half way. Electrical opportunities are everywhere in any city, on the streets, in the home, in the office, in the factory, in the store, and in the workshop—on the surface, overhead and under ground—wherever men and women live, labor, eat and sleep.

New Business.

There is no standing still in the electrical business and a central station is either going ahead or falling back. As a matter of fact, a really healthy electric company should be behind with its new work most of the time, should be rushed with orders and straining to keep up with them. It is not meant by this that there should be insufficient methods, or insufficient help, but that the pressure of constantly increasing demands for electric energy should be impatiently pushing forward the orders awaiting their turn for attention.

But this great pressure of work, these insistent demands for attention—what are they? Just the visible indications of opportunities which have been stirred up and opportunities which have been met on the way in. And the central station will obtain the full advantage of these opportunities by means of its "New Business Department."

Objects.

The great problem which central station managers are trying to solve is one of equalization. It is highly desirable to increase the sale of electric energy in every legitimate way, but some ways are more profitable to a company than others. In a growing city it is an easy matter to build up a "peak." But it takes efforts and brains to broaden the "peak," to build up a day load and to reduce the difference between the peak load and the minimum demand. These are prime reasons for the existence of a "New Business Department." It is to this department that the central station manager must look in order that he may obtain a proper load for every hour of each day, and every day of the year.

Foundations.

In organizing such a department it is well to consider what are the requisite foundations upon which to build. In the first place, there should be a cornerstone on which is graven the words: "Electricity for Everything, and Everything for Electricity." This should be adopted as the motto and slogan for all connected with the department. With such a cornerstone, the remainder of the foundation should consist of: (1) Energy—untiring, unswerving energy—the kind which never stops. (2) Vigilance—the watch-dog of progress—the sleepless element which takes advantage of every opportunity. (3) Alertness; quickness to see an opening for business and readiness to act upon it. (4) Aggressiveness; so that old methods and conditions may be successfully combatted and changed to conform with modern ideas. (5) Persistence; in order that prospects may be converted into actualities. (6) Knowledge; which is the mother of good judgment, and (7) Enthusiasm; the quality which compels by force of belief—the combination which oils the mechanism of a business and cements the forces for a common cause. These are the principal elements which are required as a safe foundation for a New Business Department, and with a proper admixture of each, the superstructure will grow of its own volition.

Staff.

A New Business Department is no longer considered an experiment or a fad—it is a necessity in the operation of a central station. The generator is the heart of the plant, but the New Business Department is the lungs. A man cannot get along without a heart, neither can a central station. A man can get along with only one lung, or part of a lung, but he will die if the part shrinks up too much—and so will a central station. For cities of 50,000 population and under the staff of a New Business Department proper, may consist of from one to twelve individuals, depending altogether on the size of the city, the local conditions, and the rate of speed with which certain objects are to be attained. There has been an inclination in some quarters to look upon this department as an extravagance, which tended towards excessive plant investment; but this theory is easily exploded. A properly organized and well-operated New Business Department not only points the way to profitable extensions, but increases the value of present investments by developing paying business existing under a company's lines and selling energy during those hours when it would otherwise be wasted, or, at least, not fully utilized. Let the central station manager select a good man to put in charge of the New Business Department, and let that man add to his assistants as he feels the necessity, and as circumstances warrant. An energetic man will soon stir up more business and more prospects in a city of 10,000 inhabitants than he can take care of himself, and he and those laboring with him will have pleasure in watching the growth of the new business added as the direct result of their efforts.

The Work.

It is safe to say that no city on this continent, no street, no block, and no house can claim to be properly illuminated, or to have all the electricity consuming devices which might be used with advantage. It is safe to say that in every city of any size there are hundreds of horse-power in steam and gasoline engines being operated at a greater cost than necessary, just because their owners have wrong ideas about electric energy and are not aware of the great advantages to be derived from its use. It is safe to say that there are many electric appliances which could be installed in each household now using electric light. In every community there are many thousands of dollars in revenue waiting to be picked up from the sale of electricity, the production of which would not increase the central station plant investment to the extent of one cent. As a matter of fact, the people really want to know all about the possible advantages of electricity, and this curiosity should be stimulated and satisfied by the central station, as it is entirely in line with the growth of its business. More light and more power can be sold to consumers, as well as non-consumers, but it must be done by hard

*Paper which, upon recommendation of the Committee of the National Electric Light Association, was awarded the second prize ($300) in a competition instituted by the Co-operative Electrical Development Association.

work. Men with a knowledge of salesmanship and business methods are required to successfully spread the news of electrical possibilities, to swell the number of consumers, and increase the amount of individual consumption. This is the kind of work cut out and waiting for the New Business Department.

New Methods.

But if it is discovered by a manager that so much valuable business is waiting attention, what must he do to gather it in? Well, there are four ideas which he must grasp before starting on his campaign, namely, that the public requires education, instruction, persuasion and demonstration. It is not usual for men or women to want something which they do not know exists; and after they have been taught that something does exist which would better their condition, they require to be instructed as to its advantages. In a city of 20,000 population, a company may have 3,000 consumers—all using light. Perhaps the manager contentedly leans back in his office chair, and, in answer to an inquiry, says: "Yes, business is good, we keep adding to our consumers right along, and must soon increase the capacity of our plant." And at the same time his load curve may probably resemble the spire of a church as much as anything else! Does he try to broaden his "peak"? Does he try to equalize, so that there may be a profitable day load? Maybe he is too busy to do more work himself. If such is the case then he had better obtain a means of educating his public. His 3,000 customers could probably be increased to 4,000—but let us stick to the 3,000. They are all using light—splendid! What do they want first? More light! It is an axiom, in this business, that the more opportunities there are for using light, the more light will be used. Some of the residences are without porch lights, hall lights, portable lights, cellar lights, outhouse lights and outdoor lights. The stores want more inside lights—and more electric signs. The factories and workshops need more arc and reflector lamps—good light makes cheerful and efficient workmen and good workmen deserve good light.

Electric Appliances.

What next! Do those householders know of all the electric appliances which add so much to the comforts of life? Well, maybe they do know of some of them—but not from the central station office. And yet those housewives are ready to use electric toasters, chafing dishes, irons, sewing machine motors, plate warmers, coffee pots, curling tongs, broilers and a dozen of other conveniences. But they must be told about them.

Anything else? Yes, just POWER—but spell that word with capitals, for it usually means day load, and that is what our friend, the manager, is looking for. That city of 20,000 is using lots of power in intermittent and constant operation. How much of it electric? Is the manager going to sit down until new factories start, and wait for the promoters to come to his office and inquire what can be done? If he does, he will probably have few inquiries. Is he going to wait until those existing power users who have steam and gasoline plants meet with accidents and then expect to have them ring him up for information? Well, maybe he'll have a few calls, but he'll have fewer orders.

What must be done to obtain these valuable kinds of business? Educate, instruct, demonstrate, persuade. If you want to sell more light, show your customers that they need more. If you want to derive the increased income from the use of electric appliances without increasing your investment, you must create a demand for the appliances. If you want power consumers to hold your plant down during the daylight hours, then show the power users in your city the advantages of electric energy. They must learn of the convenience, cleanliness and reliability of electric motor-driven power. They must be shown the saving in insurance, interest and depreciation. They must have all these things explained and demonstrated to them. They must become interested, then anxious, then hungry.

Electric Irons.

The company with which the writer is connected operates in one city with a population of 225,000, and in seventeen other cities with populations varying from 4,000 to 25,000 and has upwards of 30,000 electric consumers. About eighteen months ago it was decided to stimulate the sale of electric laundry irons for use in private dwellings, some hundreds having already been installed in various laundries on the system and found to be giving great satisfaction. Within twelve months there were installed in residences over 1,600 irons, which were all paid for by the consumers using them. Careful data were compiled and it was conservatively estimated that the average monthly income from each iron was 65 cents, or equivalent to $8 per year. It was also apparent that those who had the irons were highly pleased, and, in numerous instances, were inquiring for other appliances. But many did not have the irons that would gladly use them, who could not or would not spend the money to buy them. Now, here is what the company discovered: Electric irons were good things; day load, lighting rates, no increased plant, line, transformer or meter investment; average income at least $8 per year; 1,600 of them installed! Why not 10,000? But the people won't buy them! Well, let's see! Every thousand irons out increases the annual income $8,000; 10,000 irons would mean $80,000! Just like finding it! What was to be done? Invest a little money. Take a little risk. Loan the irons to customers who will use them.

That is what our company has done. The first order placed was for 3,500 irons, and within twelve months from the time the plan was put into effect, the company will have loaned not less than 7,500 irons, and there will probably be in use on our system altogether 10,000 electric irons in 1907. That is one way of getting new business and making it easy to obtain more.

Buying Old Plants.

One more reference to the means adopted by the same company to obtain power business. It often happens that a power user may be interested in electricity, but he has his money tied up in a steam or gasoline engine and does not wish, or thinks he cannot afford to invest more. During the past two years our company has purchased such plants, in units averaging 20 hp each, to an aggregate of over 1,000 hp. These engines have been resold and shipped to territories away from the company's lines, and their former owners are now invariably strong advocates of electric energy. But engines have only been purchased in this manner where there was no other way of obtaining the electric power business. Owing to the lower cost of motors, most of these exchanges were made without loss to the company, although in some cases it was figured out that an initial loss must me met in order to obtain profitable and permanent power business.

Ways and Means.

And now we come to the question of ways and means. How is the public to be educated, instructed and persuaded? What is it that the new business department must do to begin with, and what must it continue to do? The answer is: Advertise, Solicit, Exhibit, Systematize, Foster Existing Business. The success of the central station is first dependent upon good service, but most of the different problems in generation, transmission and distribution have been satisfactorily solved, and most managers know how to obtain an adequate amount of energy. But the limits to the sale of electricity have not yet been sighted, and the more these limits are sought, the greater distance they seem to be away.

The New Business Department cannot be divorced from the other departments of the company. It must, of necessity, keep in touch with the operating and construction ends, must be close to the accounting side, and in constant communication with the customer's department. The manager of the New Business Department may not be an engineer, but he must have absorbed a considerable amount of technical knowledge. He may not be an accountant, but he must know how to figure. He may not be a meter reader, a collector or a trouble man, but he must know what are the difficulties in each position. And, above all, he must know the public. He must know its failings, its prejudices, its needs and its opinions.

Advertising.

In the conduct of a New Business Department the subject of advertising is ever present. It is one of the mainstays, and must receive careful attention. But let us take it for granted that

the manager acknowledges the importance of advertising—the next question is, what are the best methods of publicity? Probably more than any one else, the man who advertises must put himself in the place of those whom he wishes to reach. With this idea before him, he will understand how to attract the attention of the public, where to place his advertisements, and when the psychological moment arrives, to produce the best results. Now, advertising of any description must attain its object by a well-defined process. In the first place, it must attract attention, next promote inquiry, then awaken desire, and finally create a demand. Again it is asked, what is the best medium for doing all this and increasing the sale of electricity? For the reason that the public cannot be all reached in the same way, it follows that all honest advertising is good. Some people never look at the advertisements in the daily papers, but will eagerly scan each advertising page in a magazine. Others never see an ad. in a periodical, but yet their eyes catch the notice on a billboard, or the card in a street car. Again, there are others too absent-minded to note anything on billboard or in car, but put a circular or letter in their hands and it will be read from beginning to end. Consequently, if you wish to reach every class, use every medium of attracting their attention. You don't require to go after all at once—but go after them somehow.

Newspapers.

Newspaper advertising pays in many ways, its returns being visible and invisible. It frequently happens that considerable space is taken in order to propitiate the press. The friendship of your local papers is important. Foster that friendship, but do not neglect the space you take just because you think it is there always, and the ad. may be changed at the same time. That space is valuable to you in proportion to the circulation of the paper, just as the editor may be valuable to you for the same reason. If your ads. are built right, if they attract attention and SAY SOMETHING, they will help your business, and increase your income. It is a good plan to tell one thing at a time, to change the copy frequently, so that it may not become stale, and to use a snappy, concise style which will gradually draw a regular following of readers, who will look for your ad. in the paper just to see what you have to say. What you print will be read by consumers and non-consumers. Say something to each. The first-named should be using more current. Point out to them where they need more. The others need to begin. Show them where they will be better off. Create the desire. You do not require to be an advertising expert. Know your own business. Be thoroughly acquainted with the public needs. Talk in the ad. as you would to a prospective customer sitting in your office. Attract attention—then be short, direct and crisp, and let your words show that you believe in what you say and they will carry conviction with them.

Regarding the many valuable media of advertising other than newspapers, the business manager must, of necessity, be governed by local conditions and his own experience as to the advantages of each class. It is desirable to vary the manner of publicity, but to keep at it all the time, remembering that constant drops of water will wear away the stone, and that indifference may gradually be changed to interest, and antagonism to friendship.

Circulars, Etc.

The mailing of circulars separately or along with bills is a successful way of arousing interest, but the circulars require to be carefully prepared—printed on good paper and always artistic. Neat booklets or folders should be interchanged with the circulars, and each should draw attention to one subject only. Billboards are splendid for special announcements and catch the eyes of many who will not read the papers. He who runs may read a poster—and many read and remember. Street car advertising is also valuable to impress an idea on the public. If a man is sitting in a car for ten or fifteen minutes and one of your ads. is opposite to him, he will read it whether he wants to or not. And if what you say is catchy or important, he will not forget it.

Follow-up Letters.

"Follow-up" letters are a dignified and desirable means of drawing the attention of selected people to a subject which should be of special interest, and are always productive of good results. These letters should have a personal touch to them, and should be neat and attractive in style and diction, avoiding altogether the appearance of a general circular. By this means the individuals you wish to reach are talked to without chance or haphazard.

Advertising on Bills.

It has been found that one of the best ways of drawing attention to a subject with existing consumers is to use the backs of monthly bills. If you wish to advertise electric appliances useful in a home, put a snappy notice on the backs of the bills. If you wish to have merchants consider window lighting, electric signs, or fans, talk to them briefly on the backs of their bills. Say something different each month. Somehow every man and woman will look at an electric bill to see the amount. When they see the amount let them also notice a bold line reading "See Other Side." They'll turn the bill over and read your ad. That's what you want them to do. The new business manager should do his advertising well, thoroughly, intelligently and systematically. If he cannot do it himself, or have some one on his staff who can, he had better pay an ad-smith to take the details of the whole matter off his shoulders. But let him advertise and do it right.

Soliciting.

Advertising in the electric business is principally to arouse curiosity and invite investigation. Its object is to induce the reader to ask questions, and perhaps the way for getting business. But it requires a personal interview to close a contract, and the prospective consumer must either hunt some one up or some one must hunt him up in order to bring matters to a desirable climax. It is a good plan for a representative of a company to do the hunting. The man who reads the ad. might have good intentions, but a bad memory.

"The best cause requires a good pleader," and the best managed New Business Department requires good solicitors. There are some lines in which a solicitor requires only to be a good talker. Not so in selling light and power. A good talker is all right, but he must first be honest, earnest and straightforward, and what he says must carry with it the ring of truth. The solicitor goes out among the public. He meets the people in their homes, offices and places of business. He does not represent himself, he represents the company, and the public is going to judge the company by the action and words of the solicitor. Often he is the only one about the company whom the customer knows. The president, directors and officers may be men of standing—great men in the commuuity—but the average customer does not know anything about them. He judges the officers by the kind of men they send out to talk to him. Do not think that any kind of man can solicit. Have men who KNOW; men who can make friends; men who can mix well and men who wear well.

There is a great difference between a man coming to you to do business, and you going to him. The first presupposes a desire in him to act; the second a desire in you to induce him to act. Consequently, solicitors should be trained and instructed.

Regular Solicitors' Meeting.

In this connection it is well for the manager of the New Business Department to gather his staff around him at least three times each week to discuss matters in hand, to answer questions and smooth out difficulties. New conditions are constantly arising which require to be met. Information is constantly coming in which requires to be distributed. Reports about new buildings, new building permits and new tenants must be dealt with, and often a daily meeting is necessary—and advantageous. Direct solicitation is the safest and surest way to obtain business, and the solicitor must be equipped for his work. The electric company has much to do to overcome competition, indifference and inertia, and it is through the solicitor that a large amount of this active and passive opposition may be removed. He must educate and demonstrate. He must make the public realize that what his company is selling is something in which every one should be interested; something that lessens the cares and responsibilities of life; something that is superior

to everything else for doing similar things; something that reduces work, lightens labor and saves their pocketbooks from certain ravages.

Solicitor's Tactful Work.

It is essential that solicitors should not be too technical in their talks with prospective consumers. There is nothing to be gained in befogging a man by injecting into a conversation a mixture of amperes, ohms and volts. The solicitor is not selling kilowatts; he is selling light. He is not selling amperes; he is selling heat and power. If he has acquired technical knowledge, let him forget it when talking to an ordinary man or woman, and he will sell electric energy with less trouble. Those engaged in the electric business are apt to forget that the public does not know as much about it as they do. It is a fact that a very large percentage of the community does not know of the conveniences and simplicity of handling the current, even when they have it for lighting their homes. Many people have a fear of electricity on account of its mysterious nature; some thinking it as dangerous as lightning. Here is where the careful work of the solicitor may do good every day. He can point out the safety of electricity in the home, the impossibility of upsetting electric lights, and, consequently, the reduction of fire risk; the dispensing of matches where there are children and careless people; the abundance of pure air, the saving of doctors' bills and the convenience of the many wonderful electric appliances which are adapted for house use.

To the merchant the solicitor points out the advantages of electric light for showing his goods. For keeping his ceilings and store clean, by an absence of smoke and smut, for reducing the heat in summer, and permitting good air at all times. For improving the decoration of his windows and keeping them clean winter and summer, so that the public may see what he wishes to display. And then he shows him the score of electrical devices which may be operated to advantage inside his store, and help him make money. And, lastly, the solicitor takes his merchant to the door and points out how and where an electric sign will work for him while he sleeps; how he can burn his name and business into the public mind, and how the company will take care of the sign, turn the current on and off at the proper times, and relieve him of all responsibility in the matter.

The power user has much to learn, and to a great extent the solicitor must be his instructor. He goes into a factory in the crowded part of the city, and what does he see? Probably 50 per cent of the power generated, wasted and dissipated in shafting and belting before the machine commences to work. Probably ten times as much space as is necessary given up to engines and boilers—and valuable space, too. Probably twice as much money invested in the power end as there should be, and, consequently, twice as much interest and insurance, and four times as much depreciation continually piling up. He probably finds plenty of noise, smell, dirt and inconvenience, to say nothing of high-priced skilled labor to keep the wheels moving. Little by little the solicitor can show that electrically-driven machinery represents economy of power by means of direct-connected units; that motors occupy little space, and may be taken off the floor and stuck on the walls and ceilings; that they cost less than half the price of any other kind of power machinery, and do not require skilled labor to operate them.

Appliance Showroom.

The work of the solicitor may be greatly aided by the company having a showroom in which all kinds of electrical appliances, big and little, may be seen and their usefulness and convenience demonstrated. The public may thus become familiar with the workings of the different apparatus, and the solicitor will have an advantageous place to which he may invite prospective consumers, and there explain the actual operation of what he wishes to sell. Too much care and attention cannot be given in the arrangement and fitting up of this room. Lamps of every size and design should be tastefully displayed so as to obtain the best effects out of each. With them there should be shown the current-saving devices, and also electric meters in operation. The latter will help to educate the people to be familiar with the meter's mechanism, and tend to inspire confidence. Then there should be specimens of all sorts and varieties of practical appliances which may be used in the house, office, store and workshop. In short, a continuous exhibition of what may be had in electric apparatus and what may be done with them. In this showroom there should always be plenty of small booklets, giving illustrations and concise information regarding the different kinds of appliances, so that those inspecting them may have something to carry away to refresh their memories, and arouse the interest of others.

Electric Office Display.

But the manager of a central station must show his belief in what he produces and sells by using freely what he wants OTHERS TO BUY. He preaches that an electric sign is the best kind of advertisement. Does his company use one? He advocates a well-lighted store and a brilliant window. But how about the company's office? Is there plenty of light, and is it burned far into the night? Has he electric fans, footwarmers and radiators installed for the benefit of employes and customers? What is the use of his saying that "trade follows the light" if he does not illuminate his own premises? If he has no electric sign over his office, what is the use of his preaching that the same law which draws the moth to the flame of the candle also draws the buying public to the brilliantly-lighted store? Let deeds as well as words show that he has plenty of confidence in his own product.

System.

It was Thomas A. Edison who said that "genius is partly inspiration, but mostly perspiration." In other words, energy is what produces results. But much energy may be lost because it is not systematically applied. The manager of a new business department will find that system is a good servant for him to employ. The larger the business transacted, the better must be the system, and that system is best which substitutes knowledge for guesswork, and economizes time, labor and money. There must be system in advertising, and system in laying out the work for solicitors. There should be system in noting the results of advertising and the returns which solicitors bring in. There will be inquiries, leads and prospects, the data concerning which requires to be kept up to date and accessible. There should be system in handling what has to be done, and what has already been accomplished. System in noting sales, terms, proposals and contracts—records of buildings to be constructed, names of owners, contractors and tenants, and the particulars regarding the probable requirements of each. In records of prospective power consumers, complete information is necessary about present installations, kind of machinery, makers' name, horse-power, use and hours of operation.

Care of Customers.

In all branches of the New Business Department's Work, system is needed, but not the kind of system which becomes a tax and a burden. The longer he is at his work, the longer he is dealing with the people, and the longer he is trying to sell electricity, the more will the new business manager be impressed with the fact that the best advertisement is a pleased customer, and the best possible solicitor is a consumer who is satisfied. All the work of his department is practically wasted if the new business taken on is not properly cared for. It is a regrettable fact that, as a rule, there does not seem to be a proper sympathy between the public and the electric company. They do not seem to understand each other. The public is too liable to think it is being overcharged or imposed upon, and the employes of the company to think the public kicks too much. And the fact is still further to be regretted because the companies are largely responsible for this condition. Employes are not trained to be courteous and polite, to put themselves in the customer's place, and understand why they ask questions about what they do not know, and why they "kick" when those who are taking their money do not give them proper attention and civil answers.

Good Service.

The importance of this subject cannot be overestimated, because it is up to the company to do everything possible to establish and maintain friendly relations with its customers. The

New Business Department must be backed by good service, and "good service" only begins with the production of the current. Good service requires that there should be polite and attentive clerks, collectors, meter readers and trouble men; that complaints shall be listened to and promptly investigated, and the settlement of disputes and adjustment of claims shall not be sidetracked and postponed beyond reason. The very existence of a company depends upon the good will of its customers, and for this reason inattention and discourtesy on the part of any of its employes should be considered unpardonable.

The agents of the New Business Department go out after business. They approach a man in his own house or office and then it is that a man is liable to talk freely of how the company has treated him. If the treatment has been bad, the agents' chances of doing more business are very slim. If the treatment has been good, the chances for more business are excellent. Again it is pointed out that the best means for advertising a business is to be advertised by its friends. If a man is a consumer, look after him. If he has a complaint or is in trouble, give his case immediate attention. His general opinion may be that corporations have no souls, but he will find that individuals in the corporations have, and it is by the work of the individuals that he is going to judge your particular corporation. If a man is a power user, he is depending on that power to help him earn his daily bread. He may have a large number of employes, or he may be operating a motor by himself. In either case, if the power goes off, or some trouble occurs with his service, he is put to inconvenience and expense until the trouble is rectified. As a rule, when he has trouble with his motor or service, the first thing he does is to call up the electric company. The first thing the electric company should do in such a case is to give this man's trouble the right of way. Whether the cause of the trouble is the fault of the company or the consumer does not matter much; the fact that the consumer is shut down is sufficient reason to see that he may be running again as quickly as possible.

It is this kind of treatment that makes friends for the company. It will be found that one of the most successful ways of convincing prospective power users that the energy you have to sell is the energy they need, is to take them to plants which are being operated by electric power for similar purposes to what they would use it. Then have these consumers who have been using power for some time tell the prospective customer how electricity works; what are the advantages and troubles (if any) and what is the cost of operation. The prospective customer is liable to think that the agent of the company is prejudiced, and you cannot blame him. Besides, the man who is trying to sell him a steam or gasoline plant has probably told him something just the opposite to what your agent has said. But if he is going to run a machine shop, or a planing mill, or a foundry, or a peanut stand, take him or send him to some of your customers who have been running similar plants with your electric power. And if you have treated your customers right they will honestly help you to win others—and frequently put themselves out of the way to do it.

Results.

However, results are the best test of all work, and there is nothing problematical about the results to be obtained by a New Business Department if it is operated with diligence, intelligence and perseverance. Let the department manager cultivate among his assistants a spirit of pride in the work. Let him encourage and enthuse them, so that a healthy emulation may exist; an emulation to excel each other for the benefit of the company's business, and to pull together, so that the successes of to-day may be but the stepping stones for the achievements of to-morrow. Let there be politeness, attention and courtesy in all ranks and at all times, and under such conditions the central stations will surely prosper and the tiny stream of new business which once had to be coaxed and persuaded will eventually begin to flow as a river, and continue to grow in force and volume day by day.

The Development of Central Station Work in Philadelphia.

When discussing from the central station standpoint the subject of how to get new business, the amount secured, rates, etc., it is necessary to bear in mind the local conditions and characteristics of the city and people with whom one has to deal. Surrounding Philadelphia prior to 1854, there were a number of townships, such as Germantown, Chestnut Hill, Richmond, Frankford, etc., which in that year were consolidated with the city proper. Although in 1854 all the villages and settlements within the limits of the County of Philadelphia were united into one city government, it took many years for the local conditions existing in the various districts of the city to become eliminated.

The local conditions then existing resulted in the establishment of a great number of companies, whose business it was to generate and sell electricity. Hence, in 1899—at the time the Philadelphia Electric Company was formed—there were no fewer than 26 companies, of which 17 were operating and actively engaged in generating and selling electricity; with a great variety of rates and an equal variety of conditions governing operation. The problem of how to unify the methods employed by these various companies, particularly from a standpoint of rates, was a very serious one. It was further complicated from the fact that up to the year 1904 it was necessary to operate all of these companies as separate and independent organizations. Since that time, however, it has been made possible, by legislation, to bring all the companies under one direct management, and to reorganize and unify thoroughly the generating, commercial and executive departments of the business.

When the subsidiary companies obtained their original franchises from the city of Philadelphia, these franchises covered the rights for the generating and selling of electricity in certain definite districts, which except in one or two instances, did not overlap. Curiously enough, when the Philadelphia Electric Company started the work of unification it was discovered that the old company boundaries, with a few minor changes, formed natural districts, not only with respect to territory but also to a great extent with regard to classes of business.

After a slight redistricting, it was immediately discovered that the most efficient organization possible could be obtained by the establishing of district offices, each office being in charge of a district manager, who was held responsible for the entire section over which he was placed; receiving, of course, his general instructions from the main office and being constantly under the supervision of the executive offices and the engineering department.

These district managers are given as many solicitors as the experience of the main office and the recommendations of the various managers prove to be wise. Although the solicitors report to, and receive instructions from, the district managers, the actual control of the entire soliciting force is vested in the general agent; and in this way the supervision of their work is very complete.

Whenever a solicitor unearths a prospect of any magnitude, the district manager takes charge of the matter personally and consults with the general agent at the main office; but in the case of the ordinary contract, the district manager is allowed to develop his own resources and personal initiative, subject to the rules, regulations and policy of the company. This system has the effect of placing the district managers on their mettle, thus obtaining the best results and giving the best service and attention to both new and old customers, and they all vie with each other in making their district stand out prominently in the monthly reports of the various managers. This leads to the constant "driving" of the solicitors under them, inasmuch as the only way a good comparative showing can be made is to see to it that the solicitors are putting forth their best endeavors.

As stated above, the districts were discovered to be natural ones with respect to classes of business. One district would be in the main a manufacturing district, another a residence district, a third a retail store district, and so on. It was frequently found that the solicitor who did not produce especially

good results in, say, the power district, would prove a very good solicitor in the residence district. In several instances a solicitor has been transferred three or four times before locating eventually in a district which best suited his individual characteristics and ability. This system undoubtedly tends to produce a soliciting force of maximum efficiency.

Some years ago the growth of the business and the demands for solicitors of special training in certain lines were such that it was found advisable to establish special departments at the main office, directly under the general agent. The power department and electric sign department are two in point. Solicitors especially trained in these lines were employed. In the power department particularly, it was found that certain technical and engineering knowledge by the solicitors was required, and the present employees of the departments mentioned are in fact specialists in their particular lines. All inquiries regarding large power installations are immediately referred to the power department for investigation and follow up. Special tests are made, sometimes covering a long period. On the result of these tests, the contract department bases its estimates of probable cost. The thoroughness with which this power proposition is handled is evidenced by the astonishingly close comparison between the bills actually rendered and the estimated use.

In the same manner all inquiries regarding electric signs of any description are referred to the sign department. The peculiar conditions governing the construction of signs and their erection make it essential, if it is desirable to have satisfied customers, that the sign solicitors should know what they are talking about and have the necessary combination of artistic sense and practical knowledge. This system has produced most admirable results.

As the power department developed, it was found necessary to subdivide the work carried on into special classes. At the present time several men are working on special lines in this department, notably in soliciting power for the operation of electrical refrigeration machines. The power department is also carrying on what is known as a block canvass of the entire city. The power district is examined by the use of standard maps, and canvassers are obtaining data regarding every manufacturing establishment. The locations are plotted upon the maps, and the various data regarding each are properly tabulated and filed; the attractive prospects are first worked, followed later by those that look less promising.

About seven or eight years ago a department was organized to act in co-operation with the district manager, called the "Commercial Inspection Department." The men in this department have been thoroughly grounded in the principles of illuminating engineering, not in too technical a sense, but more especially in the common sense principles which govern the use of electric light. This department is at the service of the customers, absolutely without charge, in the event of bills being unsatisfactorily high or the illumination being not quite what is desired. This department consults with the customer, goes over the installation carefully, studies the situation and makes recommendations tending to improve the lighting conditions and to make the illumination as economical as consistent with proper lighting, the policy being to give a customer the maximum amount of light at the minimum of expense. From time to time customers are reminded of this service and urged to make use of it, and that it is appreciated by them is certainly unquestioned.

Probably one of the most original features of the Philadelphia Electric Company's organization is the monthly meeting of the solicitors, instituted by the company some years ago. At these meetings, which are presided over by the general agent, papers are prepared and read each month by the engineers, district managers and other employees. These papers are upon a variety of subjects, all of them, however, being upon a topic which has some distinct relation to the business-getting department, and which is of interest to the solicitors. After the papers are read, a general discussion follows, in which all employees present are expected to take part. These meetings are in effect miniature Edison conventions, and many of the papers read would prove exceedingly interesting to any one interested in the central station business, exclusive of the fact that they were employes of the Philadelphia Electric Company. The meetings have produced most gratifying results in the way of educating solicitors, and, what is quite as important, in keeping them advised and interested in what is being done by the electrical industries in general throughout the country and by their own company in particular.

The Philadelphia Electric Company has long been a firm believer in advertising as a means of exploiting its business. Very little newspaper advertising is done at the present time, the efforts of the advertising bureau being confined principally to the issuing of follow-up literature, such as novelty mailing cards, booklets, circular letters, fac-simile circular letters, etc.

The contract department of the Philadelphia Electric Company is in exceedingly close touch with the advertising department. This is so from the fact that the advertising is in charge of an employee of the company, who was formerly a solicitor and who was associated with the general agent, and those who have charge of the various departments under him. No advertising is issued before it has met with the suggestions and approval of the heads of the departments whose business it directly affects or is intended to promote. This, of course, results in a harmony of action and a more complete understanding than is at all possible when the advertising is conducted by an advertising agency or by a man who is made the advertising manager for a central station purely through his merit as an advertising expert. It is safe to say that no one of the larger central stations has a more cohesive business-getting department than that of the Philadelphia Electric Company.

Every central station looks with concern upon the yearly report showing percentage of lamps lost to lamps gained. It is certainly quite as important to keep business as to secure it. There is a large percentage of business lost which is unavoidable, such losses for instance as result from fires, failure, removal, retiring from business, non-payment, etc.; but there is a considerable percentage of this lost business which might be saved if the company were more closely in touch with the consumers. There are a great many people who when dissatisfied with one condition or another hesitate to make complaint, but who, when that dissatisfaction has reached proportions sufficiently great, make other arrangements for their light or power, and after having done so, notify the company to cut off the current and remove their property. This class would be reduced to a minimum if the understanding and confidence between customers and company were complete.

In an endeavor to accomplish this latter result the Philadelphia Electric Company has started the publication of a bulletin, which differs from the bulletins issued by the other central stations in the important particular that it is intended primarily for the present customers, and in a very secondary sense for the prospective customers. The reading matter of this bulletin consists of editorials and articles bearing directly upon the relationship between the customer and the company. The greatest frankness regarding all subjects of common interest is shown, and customers are invited to question any acts, rules or conditions of service of the company. The endeavor is to make it as difficult as possible for the reasonable man to discontinue the service through dissatisfaction based on misunderstanding. This bulletin acts as an adjunct to the commercial inspection department, to which reference has already been made.

The Philadelphia Electric Company controls and operates one of the four largest systems in the world devoted exclusively to the business of selling electric light, power and heat, although in point of population Philadelphia stands only eighth in the list of the world's largest cities. This showing is the result of years of experience and careful study of conditions, of constant and careful effort to perfect its organization, coupled with the consistent development and extension of its mains and station equipment. The business secured has been the result of sincere, unremitting solicitation, through the medium of personal interviews and the organization as outlined above, and has been obtained in the face of that tremendous conservatism for which Philadelphia is noted.

The Coming Flatiron.

We have commented on the shortcomings of much of the literature which is circulated to advertise the electric flatiron among ordinary central station customers who know nothing of technical matters, and have in the past (see ELECTRICAL WORLD, March 3, 1906), made some suggestions as to the special advantages of the electric iron which must be urged with the ordinary user. It is gratifying to note that some of the recent flatiron literature is better calculated to appeal to the flatiron user. We are indebted to Mr. Wadsworth A. Williams, who has charge of the bureau of display and demonstration of the Minneapolis General Electric Company, for a copy of a recent circular issued by that company which is one of the best pieces of advertising literature on the subject that has come to our attention. The first page of this circular is here reproduced. The text of the circular, which may offer some valuable suggestions to other companies getting up flatiron literature, is as follows:

ELECTRIC FLATIRONS.

Electricity has been successfully used for heating flatirons in shops, laundries and residences for the past ten years or more. The first electric flatirons were crude indeed compared to the perfected irons now on the market. The present-day electric flatiron is a beautiful, durable and perfect iron that can be used for every kind of ironing and is the only flatiron that can be heated without waste of heat or vitiation of the atmosphere.

THE OLD WAY.

Ironing, according to the old-fashioned method, was the use of a piece of iron heated from some external source of heat, difficult to control and which usually made the flatiron either too hot, so that it scorched, or too cold to do effective work. The irons were always dirty and much time was wasted in carrying them from the stove to the ironing board, which was also one of the most exhausting features of old-fashioned ironing.

THE NEW WAY.

The electric flatiron is heated from the interior by electric current passing through a resistance unit and every particle of the heat is utilized in the place where it is wanted, there being absolutely no waste and the temperature can be easily controlled. Our residence customers who are using electric flatirons tell us that they are able to finish ironing in much less time than with the old-fashioned iron and with very much less fatigue.

COST OF OPERATION.

In practical use the six-pound electric flatiron will cost upon an average five cents per hour for electric current, making it no more expensive than the old-fashioned way. Aside from the economy you can do away with the dangerous gasoline stove on ironing day or the gas range giving off its objectionable fumes causing headache and sickness, and in the summer time heating the room to an intolerable degree. With the electric flatiron the ironing can be done in any room in the house. You can iron the washing in the laundry or press clothes in the sewing room, the one iron does it all. The temperature of the room is not raised nor the air rendered unfit for breathing. They are particularly desirable on hot summer days and not less so in cold winter days when windows are closed, as few ventilating systems provide for the increased oxygen consumption caused by an open flame.

OUR OFFER.

We believe the proposition we are making you is the best and most liberal offer of this kind ever made by an electric company and we are confident that if you once use an electric flatiron you will never use any other kind. It is in this firm belief that we sell them for less than cost, on thirty days' trial and guarantee them for one year. The offer is not made to the general public, but is made exclusively to consumers of electricity on our circuits.

SIZES.

The electric flatiron is made in different sizes. The three-pound iron is the favorite for travelers and light housekeepers. The six-pound is best adapted to general housework, while for tailors the sizes run up to thirty pounds or more.

We are installing these flatirons in large numbers in laundries, shops and factories where their cleanliness, convenience, economy and durability have brought forth much favorable comment, besides the more important point which has been frequently noted, and that is the marked increase in efficiency on the part of employes that has resulted from the improved sanitary conditions caused by removing the gas or coal stove and its consequent oxygen consumption from the room.

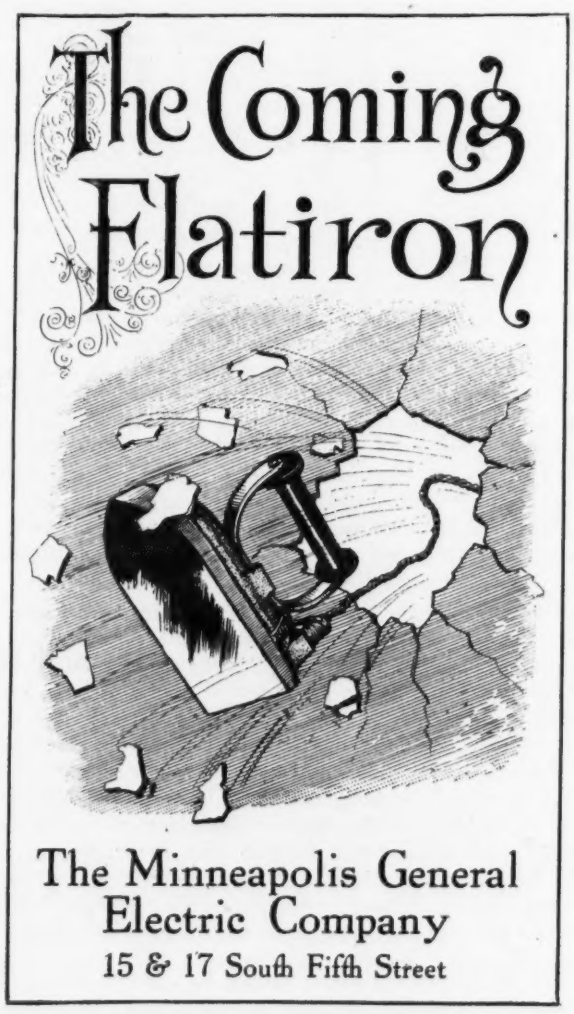
ELECTRIC FLATIRONS FOR BUSINESS USES.

We are prepared to furnish estimates on the cost of complete electric equipments for tailor shops, factories and laundries.

By using electric flatirons you can *Save* rent; less floor space; no stove. *Increase* efficiency of employes. *Improve* health; better sanitary conditions.

DIRECTIONS.

The method of attaching an electric flatiron is very simple. Unscrew an ordinary electric globe. Notice that attachment plug on cord is in two parts. Turn on the current by the key in the socket. Insert the two prongs into the base of the plug. The iron will then heat in a few minutes. The iron should be kept on its stand when not in use. Do not get into the habit of turning the current on and off by the key in the socket, but pull the plug apart as noted above.



FRONT COVER PAGE OF FLATIRON CIRCULAR.

Further instructions will gladly be given if you will call up our Department of Display and Publicity. N. W. Main 189. Twin City 1320.

ELECTRIC COOKING.

The same thermal principles that have made electric flatirons so successful are also applied to cooking with wonderfully satisfactory results. You are invited to call at our Department of

Display and Publicity, where we will be pleased to show you how this is done.

RESULTS OF A UNIVERSITY PROFESSOR'S INVESTIGATION.

"They are well illustrated in the use of electric flatirons in the laundry of an insane asylum. The electric irons do not vitiate the atmosphere, as did the gas-heated irons; do not allow starch to stick to the bottom, as they are always at the right temperature and remain highly polished by constant use. The handles are always cool. The cost of operation is found to be less than when heated by gas, and as the resistance is constant, the temperature is always right and uniform, so that they may be used economically and satisfactorily even by persons with deranged minds."—*"Electrical Catechism," Sec.* 458, *Prof. Geo. D. Shepardson, University of Minnesota.*

New Business Methods in a Town of 12,000 Inhabitants.

The Sherman Gas & Electric Company, which is one of the most progressive of the Texas central station companies, operates in a town of about 12,000 inhabitants, and has increased its gross revenue 300 per cent in two years, the company having taken hold of the property when it was in a deplorably run-down condition. Gas competition was also very severe. One solicitor is kept looking after present and prospective customers. This is a man taken from the company's operating force, so

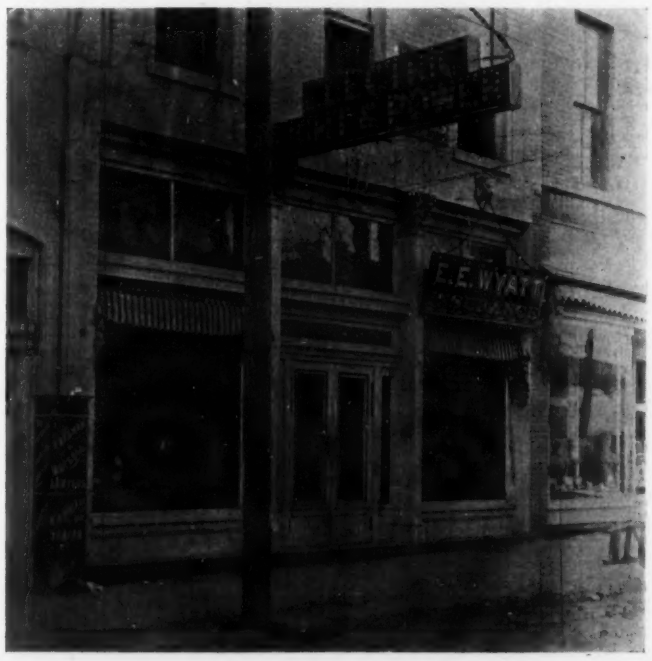


FIG. I.—OFFICE OF THE SHERMAN GAS & ELECTRIC COMPANY.

that he is thoroughly familiar with the technical part of the business and knows what the company can and cannot do from an operating and construction standpoint. Regular advertisements are run in two Sherman daily papers, one advertisement occupying three inches two columns wide, and the other four inches two columns wide. These two advertisements have copy changed frequently. Unlike some central station companies, this company believes in taking its own medicine, and has an electric sign in front of its offices as an example of what other business houses should have. This sign is shown in the accompanying illustration.

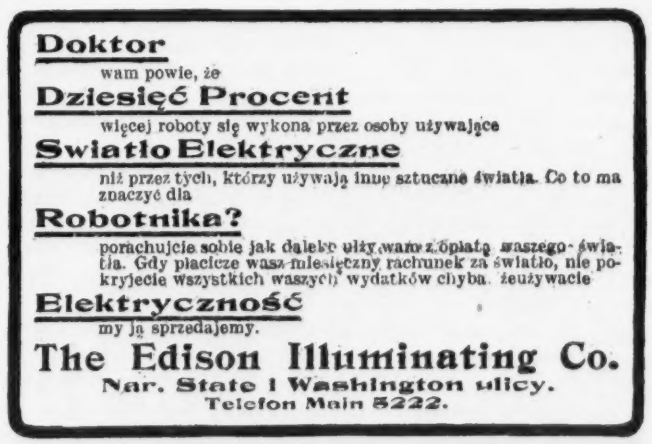
Reaching Out for the Alien in Detroit.

The great bulk of the central station advertising in the United States is necessarily and quite properly done in the English language. The population of the country, however, is polyglot, and in some sections the foreign elements are very densely massed. It has been a question with many of the companies whether it is worth while to reach out for such elements because very often the people are poor and do not understand English, and are not likely customers for electric light or power. New York has a very large proportion of such population, which must be taken into account in dealing with estimates of the possibilities of development. Lowell, Mass., with its French-Canadian factory hands, is such another place, and it is only recently that a plan

GERMAN ADVERTISEMENT OF THE DETROIT EDISON COMPANY.

of campaign has been decided upon there. Several other cities large and small could be named where the same question arises.

We illustrate herewith a couple of samples of advertising in languages other than English from the files of the Edison Illuminating Company, of Detroit, Mich. The city of Detroit has a considerable number of Polish and German citizens, and in the opinion of this progressive company it pays to make an appeal to them in their own tongue. The translation of the German advertisement herewith is as follows: "Cool and brilliant. If you have need of illumination these warm nights, elec-


Doktor
wam powie, że
Dziesięć Procent
więcej roboty się wykona przez osoby używające
Swiatło Elektryczne
niż przez tych, którzy używają inne sztuczne światła. Co to ma
znaczyć dla
Robotnika?
porachujcie sobie jak daleko użyczam z opłatą waszego świa-
tła. Gdy płacicie wasz miesięczny rachunek za światło, nie po-
kryjecie wszystkich waszych wydatków chyba żeużywacie
Elektryczność
my ją sprzedajemy.
The Edison Illuminating Co.
Nar. State i Washington ulicy.
Telefon Main 5222.

POLISH ADVERTISEMENT OF THE DETROIT EDISON COMPANY.

tricity will give you the best artificial light and the greatest satisfaction without heat."

The Polish advertisement appears to be directed more particularly to the manufacturer than to the householder. The translation of the advertisement in Polish is as follows: "The health expert will tell you that 10 per cent more work is accomplished when using electric light than when using any other artificial illumination. Consider what this means to the manufacturer and how far this saving on the pay-roll would go toward paying for your electric lighting. We sell it."

Mr. E. F. Phillips, of the Detroit Company, says that both the residence and business Polish population are, as a rule, quite generous users of electric light, and that it pays, therefore, to make an effort to reach them by advertising and canvass. This certainly seems a better and more aggressive policy than to assume, as has been done in some places, that the foreign population is too poor or too indifferent to the conveniences of modern civilization to care much about electricity. We note from the file before us of this advertising that some of the Polish examples are couched in verse.

Recent Work of the Denver Gas & Electric Company.

For more than a year past the electric department of the Denver Gas & Electric Company has shown greater progress than has the gas branch of the business. It is not meant by this that the results from exploitation of the gas business have been unsatisfactory, but rather that the development of the electric side has been so extensive that an equal showing from the gas could not be expected. This showing has been made in two ways: The broadening of the field for the application of electricity, and actual results in increase of revenue, the latter dependent, of course, in a great measure, upon the former. As a direct result of the agitation for better lighting, public and private, in Denver, the entire city to-day presents an appearance to justify its claims to being at least among the best-lighted of American cities.

In a short time every visitor arriving in Denver at night will be greeted at the Union Station by the immense arch, flashing forth the word "Welcome," as illustrated recently in these pages. Private concerns on two of the main streets have ornamented their buildings with attractive hanging arc lights, and within a short time at least one of the main streets will be illuminated with clusters of arcs on ornamental iron pillars. Boulevards and suburban residence districts have been supplied with 50-cp lighting, and additional installations of this kind will be made in a short time. This is what might be called the "public" results of the campaign for better lighting.

Preceding these installations, the business men of the city had come to a full realization of the value of lighting, from both a public and private standpoint, and the extent of their displays was most forcibly illustrated last winter, when the street lighting plant was disabled by fire and the business section depended upon these private displays of light.

By constant application and study, the commercial department of the company has kept alive the interest in lighting, expanded it and made it a stable form of advertising as well as a means of ornamenting business houses. There are not many business houses in Denver's downtown section that neglect lighting entirely. Where it is not a sign, it may be "outlining"; and where it is neither, there is at least an effort to make windows more attractive by the use of electric light. Flat rates and liberal terms in every respect have brought most of this patronage. The Denver company places all display lighting on the flat rate, including window lighting, consequently gaining the long-hour consumption. Most of this business continues until midnight.

The active campaign for window lighting began less than a year ago. It has brought not only much increased revenue directly, but has proved the entering wedge for a great deal of more extensive display lighting. Interior lighting has been given attention, both for business houses, and for residences of the more pretentious class. Success has been attained in both directions. Exploitation of display lighting has developed the fact that most of those who installed signs or outlining originally as something of an experiment are thoroughly convinced of the permanency of this method of advertising, and are generally willing to entertain a proposition for more extensive displays or rearrangements that mean some increase in revenue to the company.

This increasing of consumption by old consumers has developed in a very satisfactory manner, and forms a sure testimonial of the efficiency of good solicitation. One point that might be of interest comes under this heading. For some time, and especially at the holiday season, a great many business houses gladly increased the candle-power of their display lighting, generally from 4-cp to 8-cp lamps. The suggestion of appropriate designs has been another means of bringing about a large increase in the display lighting. As a result of this Denver has a great variety of displays, many of them to be found duplicated in other cities. Progress has been made also in display lighting in even remote suburban districts. Where the business justified it, the flat rate has been applied to districts, but there are many signs on the meter basis in outlying sections. Drug stores have taken up lighting in all parts of the city, and saloons are also making displays.

Success has been accomplished in taking the loads of isolated plants after closing time, and carrying the display lighting until midnight on a flat rate basis. This field is being developed to a considerable extent. The power business has shown great progress during the year. A great many of the largest establishments in the city are using the central station drive in preference to steam plants and other forms of power. In many cases isolated plants have been shut down, and few of the large number of new buildings now being erected will have their own plants.

One of the effective methods of arousing a desire for display lighting on the part of business men has been the elaborate temporary displays during conventions. The illumination of the streets last year during some of the big conventions was very extensive, and brought with it excellent results in the way of increased private displays. This summer the public displays for conventions will be even more extensive, and should have a correspondingly stimulating effect on private concerns.

A number of special men of the commercial department, who have been working on increasing gas consumption by old consumers have had their field extended to include the electric. They will do nothing else. This action was brought about by the successful efforts along this line in the regular course of business.

Letters to the Editors.

Rates for Electrical Energy in Boston.

To the Editors of Electrical World:

Sirs:—I note with interest your editorial of July 7, 1906, on "Published Rates." We find no difficulty here in Boston, the Edison Electric Illuminating Company having clear and definite published rates that will fit practically every condition from the largest to the smallest, and from the shortest burning to the customer who burns 24 hours a day.

In brief, our methods are a Wright demand system, combined with wholesale discounts. To take account of time of burning, a very short hour customer takes our non-contract rate and pays 15 cents with certain deductions if he should happen in some months to be a long hour customer. A long hour burner pays a primary rate of 20 cents for 400 hours per year and a secondary rate of 5 cents, equivalent to a Hopkinson system of charging with a payment of $60 per kw per year as a fixed charge and 5 cents per kw-hour consumed. Whenever on these rates the monthly bill exceeds $150 there is a discount of 40 per cent on the excess over $150 up to $550 and a discount of 50 per cent on the excess over $550.

We have a power schedule and other schedules made up on the same principle though differing in amounts. The result is, that any office boy can quote the rates of our company as well as the highest official, and our customers who pay us $1 or so a month are treated exactly the same and pay on the same schedule as customers who pay us several thousand dollars a month.

We sell current wholesale to several towns on this schedule and we are able to say to every one that our rates are the same and depend solely on the kind of service and quantity used and the way it is used, and we have absolutely no discrimination whatsoever. It is true that such a system as ours with its several schedules and several prices in each schedule, is more complicated than a simple system with a lot of special contracts and rebates outside of the system, but I venture to say that our system is far simpler than any so-called simple system, provided

that the special contracts and rebates, etc., etc., are made part of the simple system, as indeed they must be to really represent what a company is doing.

BOSTON, MASS. R. S. HALE.

Central Station Enterprise.

To the Editors of Electrical World:

SIRS:—I read with the greatest interest the excellent prize paper of Mr. Seelman, printed last month, and one part in particular appealed to me as of the most timely value, namely, the advice, in effect, to central stations to show openly their faith in their claims for the benefits to be derived from the use of the electric light for advertising, by employing it themselves for this purpose. If a central station does not employ an electric sign, or make any attempt at display lighting in its offices and show windows, what status has it for going before others asking that they incur an expense many times what is entailed to the electric lighting company for the same or a similar service?

The absence of an electric sign from the works and offices of a central station company will soon be accepted as an indication that the company is lacking in proper management. In fact, one outcome of the present lively discussion of the business-getting side of the central station industry will undoubtedly be the passing away of the old-time manager who viewed with suspicion every advancement in central station methods; who if shown how effective certain methods were elsewhere, almost invariably closed the question with the "local conditions" first, and who appeared to think that the possession of a public franchise placed the business connected therewith on a plane entirely removed from that of other lines of business enterprise. The supercession of this class by up-to-date men animated with the modern spirit and who thoroughly realize that as a business proposition the sale of current does not differ from the sale of other commodities, will rid the industry of its greatest handicap.

CHICAGO, ILL. JAMES L. TROWBRIDGE.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Induction Motor.—WERNER.—It frequently happens that an induction motor, on account of special local conditions, is operated on a circuit or frequency different from that for which the motor was designed and rated. Under such circumstances the performance will vary from the performance at normal operation. The author analyzes the effects on the motor performance, caused by either overvoltage or lower voltage or a lower or a higher frequency or changes both in frequency and voltage. —*Elec. Jour.,* July.

Repairs.—MEADE.—An article, illustrated by diagrams, giving practical hints on various repairs of dynamo electrical machinery. —*Power,* July.

Lamps and Lighting.

Progress in Electric Lighting.—LIBESNY.—A lecture held before the Vienna Elec. Soc., giving a review of recent progress made in electric incandescent and arc lighting and calling attention to the remarkable rôle which Austrian engineers are playing in this development (Auer von Welsbach, Kuzel and others). The author first discusses the fundamental thermodynamical laws of radiation and gives a review of new metallic filament lamps as well as of the Beck arc lamp and the Bastian mercury vapor lamp, all of which have already been noticed in the Digest. The paper was discussed at some length and the question was raised concerning the cause to which the superiority of the new metallic filaments is really due—whether to a higher temperature or to "selective" radiation. Satori thought that the higher economy of the metallic filament lamps is due to a higher temperature of the filament. On the other hand, Libesny called attention to extended researches of Blau (of the osmium lamp company), the chief result of his investigation being that since a metallic filament is more economical than a "black-body" filament like carbon at the same temperature, a metallic filament must have a lower temperature than a carbon filament if it gives the same cp per watt. Lombardi takes an even more radical standpoint and claims that a 1.5-watt per candle-power osmium lamp filament has a lower temperature than a 3.5-watt per candle-power carbon filament. (If this is true the higher economy must, of course, be due to selective radiation, i. e., to a greater discrepancy of the metallic filament from the thermodynamical black body.)—*Elek. und Masch.,* May 20 and 27.

Enclosed Arcs.—HARTMANN.—While the long-life enclosed arc lamp has become very popular in this country it is not so much favored in Germany where more attention is paid to high efficiency than to a long life of the carbons (the cost of attendance for renewing the carbons being much less there than in this country). The author describes several new 80-volt lamps of the Siemens-Schuckert Company, for which higher efficiency and a more quiet burning is claimed than is obtained with ordinary enclosed arcs. This result is accomplished by not attempting to get a long life and by the use of very thin carbons of special manufacture. The carbons have a longer life than with open arcs and the lamps are expected to be used extensively when the supply voltage is raised from 110 to 220 volts. In this case nothing is changed in the wiring and two arc lamps of 40 volts on the 110-volt circuit are replaced by two lamps of 80 volts on the 220-volt circuit; the latter to consume of course about one-half the current of the former lamps. The life of the carbons varies between 20 and 30 hours.—*Elek. Anz.,* June 17.

Electric Lighting of Railway Station.—A note on the new electric lighting system of Euston Station of the London & North Western Railway, which comprises some 4,000 incandescent lamps and about 250 arc lamps. Power is obtained from a plant which also supplies current for the electrically-operated points and signals. The plant consists of suction gas producers and gas engines. Direct current is generated at 460 to 500 volts and is distributed from the power house through booster balancers at 230 volts for lighting and for working the points and signals. Separate mains carry the current, also at 460 to 500 volts, to a balancer and switch room at Euston, where it is distributed for arc lighting at 460 volts, and by a three-wire system, for the incandescent lighting at 230 volts.—Lond. *Elec.,* June 22.

Differential Arc Lamps.—FOULHOUZE AND GUEDENEY.—The first part of an article on differential arc lamps for direct current and their principal methods of installation.—*L'Eclairage Elec.,* July 7.

Power.

Turbo-Generator.—A description of a 1,500-kw, three-phase turbo-alternator built by the Oerlikon Company. The turbine has an effective output of 2,300 hp and is designed to work with steam superheated to 250° C. at a pressure of about 140 lb. per sq. in. It is directly coupled to a four-pole alternator capable of an output of 1,500 kw at 2,000 volts, 50 cycles, when running at 1,500 r.p.m. Three distinct groups of vanes are contained in the turbine, but these high, intermediate and low-pressure groups are all placed in one case, as shown in the section in Fig. 1. The partitions between each wheel chamber are composed of fixed discs made in two parts which carry the guide blades. By this means the waste space can be made very small. The shaft, which is very firmly supported, is of greatest diameter inside the case, as seen in the section, so that the vane discs can be slipped off some from one end of the shaft and some from the other. The vane discs themselves are of steel, machined all over. To these the vanes are fixed without riveting and an outside ring holds them firmly in place. Every vane wheel is balanced separately and tested at 1½ times the speed it is run before the rotor is built up. For purposes of overloads a valve is provided by means of which live steam can be introduced between the high-pressure and intermediate groups of vanes. As

the pressure of the steam is the same on both sides of the discs a relatively greater clearance is allowable both between the vanes and guide and between the rotor and casing than is usually the case. Also thrust discs are not required, as no axial thrust is produced. Lubrication of the bearings is accomplished by an oil pump driven by a worm gear off the shaft, a hand pump being provided to flood the bearings when starting, and all the bearings are water-cooled. A centrifugal governor is driven by gearing from the pump shaft, which controls the steam supply through a valve opened and closed by the pressure of the steam.

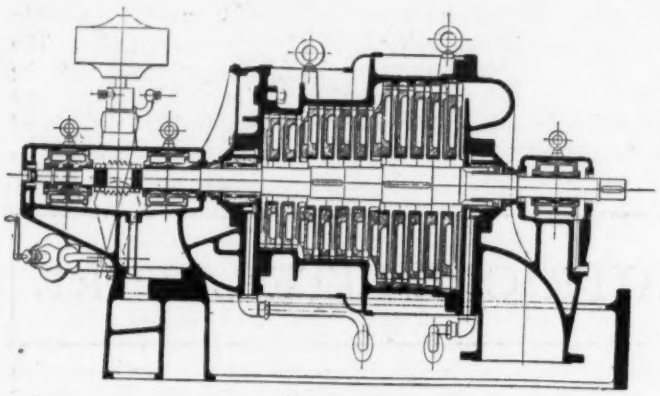


FIG. 1.—SECTION OF TURBINE.

If the speed rises by 10 or 15 per cent the governor entirely closes the stop valve. This emergency stop can also be operated by hand. A further arrangement enables the governor to automatically reopen the steam valve again when the speed has dropped to its normal value. The failure of the oil pump can also cause the emergency stop to come into action and cut off the steam supply from the turbine. A special patented flexible coupling is provided between the turbine and the generator, which allows a certain amount of freedom for end play. The alternator is of the revolving-field type. The rotor core plates are slotted all round the periphery with relatively large slots in which the form-wound field coils are embedded and held in place by metallic keys. In the center of each there are a few slots without winding. These are left empty and not filled with magnetic material in order to improve the distribution of field under the poles and improve the voltage regulation of the machine. This arrangement has been adopted in the Oerlikon Company's machines since the year 1901.—Lond. *Elec.*, July 6.

Efficiency of Steam Plant.—Vignoles.—A paper read before the British Municipal Electrical Association, in the introduction of which the author refers to the remarkable fact that engineers on board ship use considerably less coal per unit of output than electrical engineers in central stations. The author thinks that one of the great disadvantages on board ship—want of space—is a blessing in disguise. Space is so valuable that the boilers are placed close to the engines, the length of steam pipes is reduced to a minimum and everything possible is done to avoid complications which would take up room; in this way a great many losses are avoided. The author analyzes in detail the boiler house economy in central stations and gives curves showing steam consumption per kw-hour. His figures show how the steam consumption is largely increased by wasteful auxiliaries. The average load on the station is very important and the greater the load the smaller the stand-by losses are in proportion to the total. When the maximum load on the station approaches the capacity of the plant, the load factor is not very different from the average load divided by the capacity of the plant. The load factor has very little effect on the water evaporated per pound of coal, but a small load factor increases the amount of coal required for banking fires during the day. The total steam consumption appears to follow the Willans law. Tests of the author bring out the enormous importance of the steam used for auxiliaries and indicate the desirability of using electrically-driven auxiliaries throughout. There does not appear to be much difference between the economy of steam and electrically-driven sets on the test plate, but the author thinks a very large saving would be shown in practice owing to the reduction in the length of the steam pipes and the number of valves, drains, etc. In his opinion almost any electrically-driven feed pump would be more economical than a steam pump. He points out the advantage of using large units, as the steam required for the engines dealing with the load would be largely reduced, while the only advantage of using a small set would be to reduce the starting point of the curve slightly; as the steam used by the engine at light load is only a portion of the total, this is not very important—in fact, anything gained in this way would be lost by the waste in longer lengths of steam pipes, leaks at the extra valves, joints, etc., required by the larger number of sets. The author's ideal station would be one with everything arranged to run from one large engine, with a second as a stand-by, boilers close to the engine, very short length of steam pipes, small number of bends, drains, etc., and with all auxiliaries electrically driven. Capital cost of spare plant must be considered in this connection, and if three or four sets were installed this would no doubt be reduced, but in any case it would be desirable to adopt at once the largest unit that could eventually be economically used. Fig. 2 shows the estimated steam consumption in a station running one 1,000-kw set, and equipped with electrically-driven auxiliaries, the curve being calculated for saturated steam, 160 lb. pressure. The losses at light load are as follows:

Condensation in the range	100 lb.	per hour
Engine running light	700 "	"
Extra steam for generating current required by condensing plant	300 "	"
Ditto for feed pump	100 "	"

The steam for stokers is taken as 2½ per cent of the total, and the steam for the engines to deal with the load at 20 lb. per

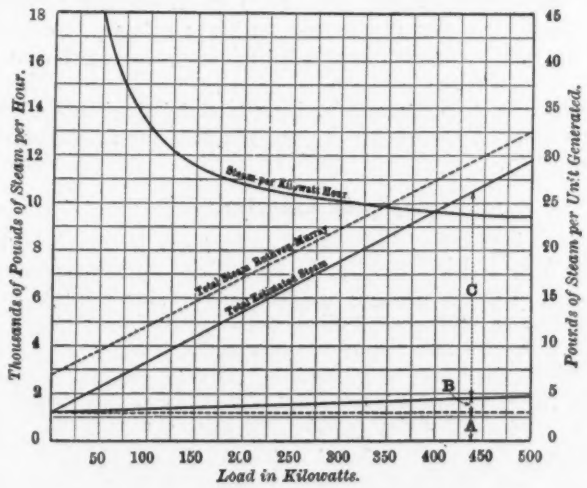


FIG. 2.—ESTIMATED STEAM CONSUMPTION.

kw-hour. In this diagram *A* represents the amount of steam supplied by the boilers when the plant is ready to generate current, but without actually giving a supply (including leaks, etc.); *B* is the extra steam required for auxiliaries to deal with the load; *C* the extra steam required by the engines to deal with the load. The dotted curve is one given by Ruthven-Murray for his station. A long account is given of the discussion which followed. Lond. *Elec.*, July 6. An editorial note calling attention to the unfairness of comparing the results obtained on large modern battleships and those in the small electric station of the author, without taking into account the difference in load factor, in size of installation, etc.—Lond. *Elec. Rev.*, June 29.

Condensers.—Neilson.—With reference to the recent paper of Weighton the author emphasizes that even now the full effect which steam condensers exercise on power station economy is hardly being generally appreciated. The total cost per unit generated is effected by the condensers in the following ways: In the first place the attainment of a high vacuum absolutely depends upon the design and proportion of the condensing plant. Secondly, by using proper condensers it is possible to reduce considerably the amount of cooling water required to condense a given amount of steam. Thirdly, if the boiler feed is taken from the hot well, the hot well temperature governs the amount of heat which has subsequently to be added to the water to

bring it up to boiling point in the boiler and thereby affects the coal consumption. Now, Weighton's tests have shown that with modern condensers the water of condensation may be at a temperature higher by 10 or 15° F. than in the old-time condensers. Fourthly, the author points out that the condensers should be able to deal effectively with any amount of steam which may be given them up to the utmost capacity. That is to say, it is desirable that the required vacuum should be obtainable with a low consumption of circulating water and a high hot well temperature, not only when the condenser is working at its rated capacity, but when it is dealing with any greater or less amount of steam within its working limits. Weighton's tests have shown that this requirement can be fulfilled with modern condensers.—Lond. *Elec. Rev.*, June 15.

Electric Winding.—MOUNTAIN.—A paper read before the British Institution of Mining Engineers on commercial possibilities of electric windings for main shaft and auxiliary work. The applications of electric windings so far have been principally in German pits and the success is largely due to the use of the Koeppe system. In making comparisons of the financial economy, however, electric winding is often compared with the use of old uneconomical steam engines, while the comparison should be made with modern high-class steam winding engines. In many cases, although the electric system works very satisfactorily, its first cost would be found to be excessive. The author believes that there is a large field for electric winding in smaller collieries where the output is less than 1,000 tons from a depth of 500 yards. Staple winding from small underground pits also offers another extremely valuable field and the electric system shows extraordinarily economical results when compared with the cost of using steam or compressed air. It is quite possible that the electric energy can be produced at such a low price that it may pay to spend more money on the winding gear and to adopt electricity for every conceivable purpose throughout the pit. Under these circumstances electric winding will have a fair chance, but where heavy winding is to be done at a single colliery and the winding absorbs probably two or three times as much power as the rest of the machinery, and is also running, say, eight to ten hours per day, there can be no doubt that it is almost impossible to compete with high-class steam engines. Various speakers in the discussion expressed their conviction of the economical superiority of electric winding.—Lond. *Elec.*, June 22.

Mine Accident.—A full account of an accident which recently happened in the Werne mine, near Hamm, in Germany, whereby the electric central station of about 2,500 hp was partly destroyed. The following lessons are drawn from the accident: It is not desirable to place all machines in one central machine house, as has become the practice in recent years. The ventilators should be placed in a special building since the continuation of work in a mine depends on their good condition. It is not desirable to use one single steam dynamo and another one for reserve. It is better to connect the electric system of a mine with some other supply circuit. From an economical point of view it is desirable for two mines in the neighborhood to interconnect their electric supply lines. The present accident would have been far more serious if the winding machines had been operated electrically.—*Elek. Zeit.*, June 28.

Electric Winding.—VALDREUZE.—The conclusion of his illustrated article describing different systems of electric winding in mines. In the present installment the author deals with the systems of Ilgner, Lahmeyer and Creplet.—*L'Eclairage Elec.*, June 30.

Gas Engines.—ATKINSON.—An article illustrated by diagrams on the use of gas engines as applied to electric driving.—*Power*, July.

Water Power Stations.—HENRY.—The first part of an article on pressure supply pipes for hydraulic installations.—*Jour. of Elec., Power and Gas*, May 19.

Installations, Systems and Appliances.

Power Supply to Tramway Systems.—WATSON.—A paper on the supply of current from central stations to tramway systems of smaller or medium size operating from 6 to 30 cars. The author first discusses the capacity of the plant required and the type of plant to be adopted. In view of the large frequent fluctuations of load it is necessary to run the plant largely in excess of the mean load requirements which seriously affects the economical efficiency of the works. The author favors the installation of a battery controlled by a reversible booster. The addition of a tramway load to a small existing lighting or power station has a beneficial effect on the costs of the producing department simply on account of the large increase in output when the tramway is started. An account of the discussion which followed is also given.—Lond. *Elec.*, July 6.

Small Local Stations.—SNELL.—A paper on relative economies of electrical supply from small local stations and from power companies. The author gives estimates of cost and the gist of his argument is summed up as follows: Small districts must take the supply from an outside source when available, at reasonable rates, rather than install a local generating plant. Facilities must be given to overhead transmission from the power station—which no doubt the power companies will take care to obtain. Facilities are imperatively necessary for overhead local distribution, as the only means for economical supply. Underground distribution would almost invariably put electricity "out of court" in competition with local gas supply. The fire insurance companies must be induced to show encouragement to householders to enable surface wiring with flexible leads (if necessary through insulated eye bolts) at a low pressure of 100 volts. An abstract is also given of the discussion which followed.—Lond. *Elec.*, June 29.

British Central Station.—An illustrated description of the municipal central station of Gillingham, using a three-phase system with supply at from 2,000 to 2,200 volts to nine sub-stations from which distribution is effected in the older portion of the area at 100 volts and in the newer sections at 230 volts.—Lond. *Elec. Rev.*, June 15.

Brighton.—In a continuation of the illustrated description of the new municipal electric station at Brighton, the 1,800-kw Westinghouse-Parsons turbo-generators are described.—Lond. *Elec.*, June 29.

Brakes.—JONES.—An illustrated article on various kinds of electromagnetic brakes for elevators. The author emphasizes that even under the hardest service and the worst conditions, the electromagnetic brake is as reliable and gives as little trouble as any other piece of electrical apparatus.—Lond. *Elec. Rev.*, June 15.

Paris.—Some more official documents with respect to the future electricity supply of Paris. The present memoirs contain little new of technical interest, but refer more to the question which one of the two rival companies or concerns should be favored by the city.—*L'Ind. Elec.*, June 25.

Office Building.—DARRACH.—A fully illustrated article on the design, installation and maintenance of modern office buildings, with special reference to electric service.—*Jour. Franklin Inst.*, July.

Wires, Wiring and Conduits.

Central Station Wiring.—BARNES.—An article pointing out the great importance of the power cables running from the generator to the switchboard and the connection that is made to the terminal board on the generator and to the stud on the controlling switch and circuit-breaker. The author gives hints on soldering terminals to cables. He points out that terminals as well as cables should have their ends tinned before using. The proper location of cables is very important. Cables should be kept as far as possible from steam pipes or where there is escaping steam or leaking water pipes. Excessive heat will rot the insulation and also leave the cables in such shape that they are a danger to men making repairs on any part of the power house equipment located near the cables. Water is a bad thing near cables. When the workingmen have the cables in place and tinned ready to solder the terminals to the cable and to fasten them to the circuit-breaker or switch stud, it is necessary to see that the cables coming from the conduit or bracket hangers have the same amount of slack in them, so that when they are soldered and fastened in place they will all be in line. The safest way to accomplish this is to solder the terminal which is to be nearest the switchboard and on the lowest stud first. As for example in Fig. 3 terminal No. 1 should be put on first. Then Nos. 2, 3 and 4. If possible they should be soldered and put in place

one at a time. That is, do not try to cut all the cables to just the right length without having any of them soldered in place. Great care should be taken that there are no nicks or burrs on the nuts for the studs, and that they are well cleaned with emery cloth and wiped with a dry piece of waste before being

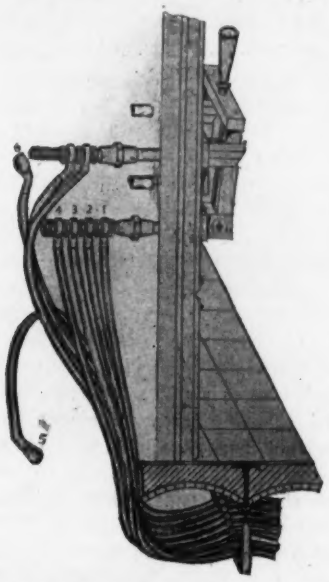


FIG. 3.—METHOD OF CONNECTING CABLES TO SWITCHBOARD.

run on the stud. Wherever possible a terminal should be placed upside down when it is ready for the cable to be soldered into it, as shown in the illustration, terminal No. 5. Terminal No. 6 should be straightened up before going on the stud. Complete instructions are given for the whole wiring.—*Elec. Jour.*, July.

Electrochemistry and Batteries.

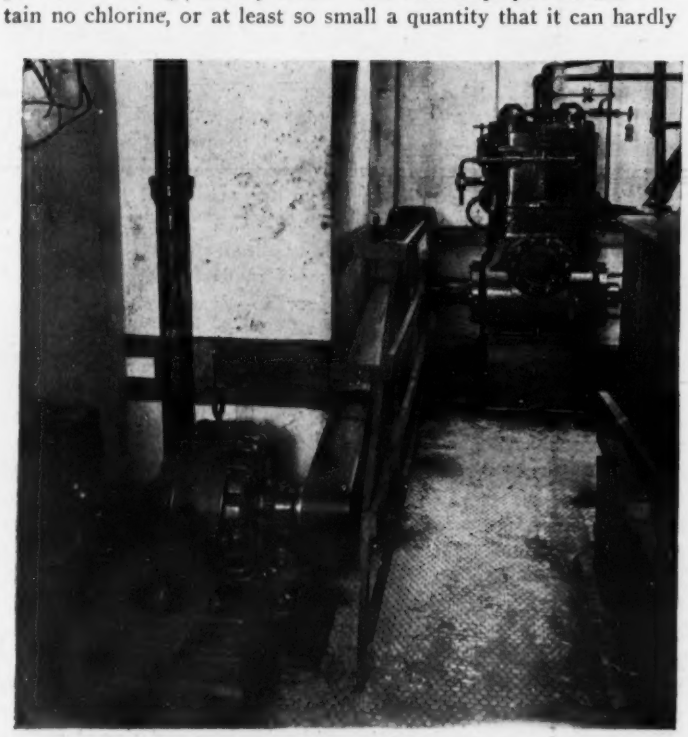
Storage Battery Acid.—Schmidt-Altwegg.—An article on impurities in storage battery acids. The acid employed should contain no chlorine, or at least so small a quantity that it can hardly be detected by analytical methods. Metallic salts must not exceed 0.01 per cent of the actual sulphuric acid present; the same quantity of nitrogen may be allowed, but no more, and only the least trace of organic matter. The author speaks strongly against the somewhat common custom of adding ordinary water instead of distilled water to make up the losses from evaporation and spraying. Tap water almost invariably contains considerable quantities of chlorides. Outside impurities may arise from the use of impure lead or from the atmosphere, which often contains gases such as ammonia, chlorine or sulphuretted hydrogen. Ammonia is very objectionable and is more harmful than almost any other impurity. On the other hand, it is very difficult to keep away ammonia from the cells since there is always more or less ammonia in the atmosphere. Acetic acid is also objectionable, so is arsenic.—*Centralbl. f. Accum.*, May 5; abstracted in Lond. *Elec.*, July 6.

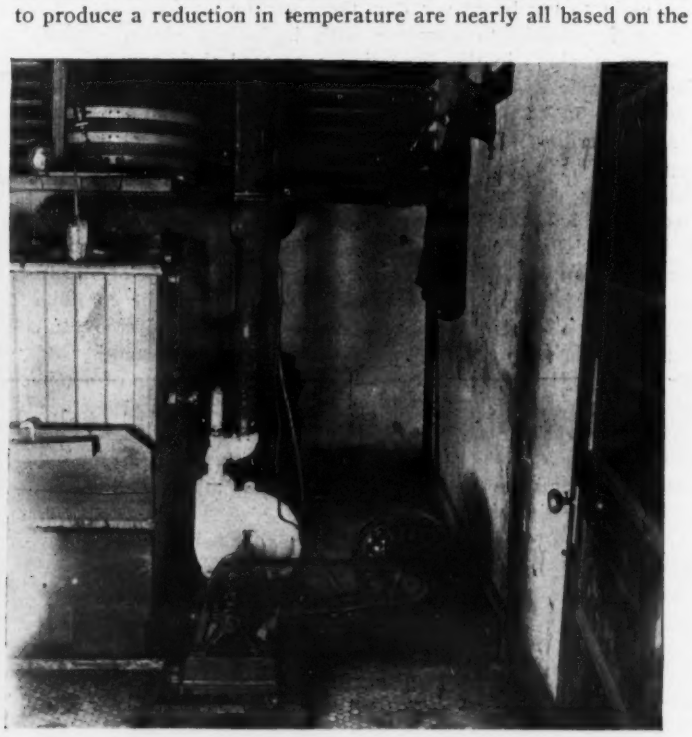
Alkaline Accumulator.—Roloff.—A paper read before the Vienna Electrical Society giving a summary of the development of the Edison-Jungner iron-nickel accumulator. Numerous diagrams are given showing charge and discharge curves, details of construction, etc. The author recognizes that the Edison accumulator represents a great progress for automobiles on account of lightness, and is also slightly superior to the older stationary lead accumulators with respect to the space required. On the other hand lead storage battery engineers have succeeded in the meantime in making lead cells for automobiles which require only half the space of the alkaline accumulator and have an output per unit of weight 50 per cent higher.—*Elek. und Masch.*, June 17.

Lead-Antimony Alloys.—Rosset.—An article illustrated by diagrams showing that the mechanical resistance and the durability of lead-antimony alloys when used for storage battery grids becomes a maximum if the antimony content is between 6 and 10 per cent, but nearer to 6 per cent.—*Centralbl. f. Accum.*, June 20.

Electrically Operated Refrigerating Plant in the Gallatin Hotel, Uniontown, Pa.

Mechanical refrigeration employing electric motors as its source of power is attracting increasing attention, which system has almost unlimited application in the preservation of food products and maintaining a low temperature in many industrial processes, as well as in domestic and household use. The machines now used to produce a reduction in temperature are nearly all based on the principle of production of cold by the evaporation of liquid to the gaseous state, and of the many systems of ice-making and refrigerating in extensive use to-day the ammonia compression system continues to occupy a pre-eminent position. It consists of a complete cycle of operations, involving three successive steps—compression, condensation and expansion. These three steps are made continuous and are constantly repeated. An ex-





FIGS. 1 AND 2.—ELECTRICALLY-OPERATED REFRIGERATING PLANT.

ample of a modern electrically-driven refrigerating plant, installed in the Gallatin Hotel at Uniontown, Pa., is illustrated in the accompanying illustrations.

The ammonia compressor, made by the Brunswick Refrigerating Company, is driven by a 10-hp Westinghouse induction motor. From the compressor the liquid ammonia is circulated in coils within the brine tank and returns in a gaseous form. The cool brine is used for the double purpose of making ice for table purposes and for cooling the beer cellar and ice boxes. Ice cans filled with fresh water are submerged in the brine tank, the average output of ice being six tons per day.

A circulating pump driven by a Westinghouse 2-hp induction motor forces the brine to the beer cellar, which is 9 ft. by 16 ft. by 7½ ft., and is maintained at an average temperature of 40° F. Besides the beer cellar there are three ice boxes, each 5 ft. by 6 ft. by 7 ft., and one cook's box 4½ ft. by 5 ft. by 7 ft. Two of the ice boxes are used for freezing purposes and are maintained at an average temperature of 16° F. The entire plant is taken care of by a young boy, which clearly shows the simplicity and economical operation of refrigerating plants driven by electric motors.

Portable Charging Stations for Automobiles.

As is well known the radius of action of an electrically-propelled vehicle is limited to the amount of electricity it can carry in its storage battery; and the latter, in turn, is limited by considerations of weight, etc. For this reason it is generally impossible for electrically-propelled vehicles to make long runs with any certainty of getting back unless the battery is recharged at a garage or charging station. Oftentimes neither of these is at hand, and sometimes where they are at hand, the arrangements

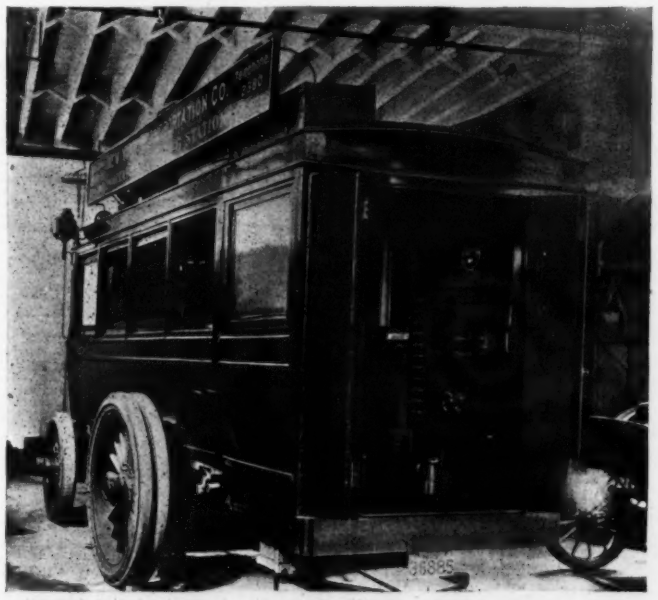


FIG. 1.—PORTABLE CHARGING STATION FOR AUTOMOBILES.

for charging are not always suitable. The New York Transportation Company, which operates the public electric vehicle service in New York City, has been brought face to face with this situation, and as a result has recently built and placed in operation the portable charging station shown in the accompanying engravings.

The equipment has been found to be very serviceable at the race tracks this season for recharging and "toning" up depleted batteries. Patrons of the company attending the races in electric cabs not infrequently make a number of calls about the city before proceding to the track, so that while a cab might be able with a fully-charged battery to make the run to Belmont Park and return, the trips in the city necessarily draw heavily on the battery so that a return trip without a toning up is not beyond peradventure. The use of the portable charging outfit has also enabled the company to accept contracts to convey large parties to and from railroad stations in districts where there are no available means for recharging the batteries, and to reach which by electric vehicles uses up almost all the stored electric energy in the battery. The portable charging station is usually kept at the race track throughout the meeting; and where contracts are made calling for the use of a large number of vehicles to transport guests to and from the railroad depot, the portable charging station is sent up to the station in advance. Under ordinary conditions one hour's connection with the portable charging outfit is sufficient to propel a cab 15 miles.

The equipment consists of a 60-hp, six-cylinder, four-stroke cycle gasoline marine engine built by the Gas Engine & Power Company and C. L. Seabury & Company, Consolidated, of Morris Heights, N. Y., direct-connected to a 50-kw compound-wound

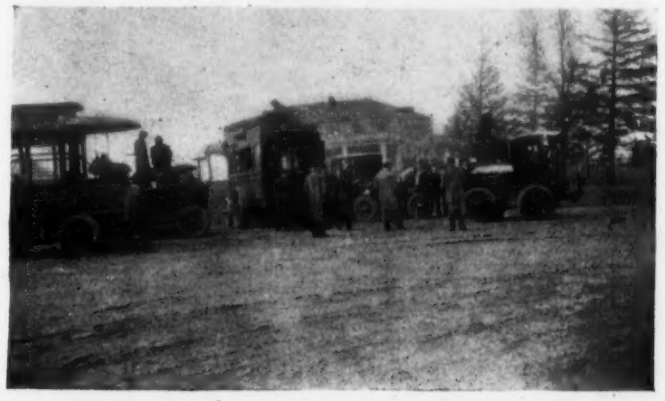


FIG. 2.—PORTABLE STATION IN USE AT BELMONT PARK RACE TRACK.

generator built by the C. & C. Electric Company, of Garwood, N. J. This generator is designed to give 220 volts at full speed and 110 volts at a lower speed. A special field regulator is provided so that the field strength will be ample for sparkless commutation at the lower voltage. The full load speed is 800 r.p.m. and the 110-volt speed is 500 r.p.m. When charging batteries the series field coils of the dynamo are cut out and the generator operated as a plain shunt-wound machine. The speed of the engine is controlled by throttle and by spark advance. The engine is water-cooled, and having been designed for marine use where cooling water is plentiful, provision had to be made for cooling the necessarily limited supply of water available in a portable station. For this purpose two standard Kinsey radiators are mounted on the roof of the car, one behind the other, and inside the housing is a standard A. B. C. blower driven by

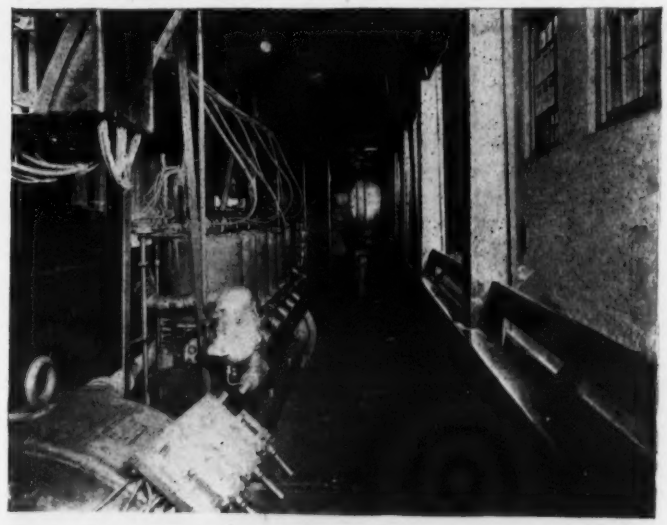


FIG. 3.—FRONT END OF PORTABLE CHARGING STATION.

belt from the engine coupling. The blower draws in air through one radiator and expels it out of the other. The water is circulated by a small gear-driven centrifugal pump. Thirty gallons of water are carried in a tank on the roof of the vehicle alongside the radiators and this tank is connected in the general circulating water system. On the opposite side of the roof of the car is a thirty-gallon tank of gasoline. This amount of fuel is sufficient for one day's ordinary operation.

The portable station is propelled by its own power, two 40-amp., 80-volt Riker motors being geared direct to the wheels. In running under its own power, the generator is operated as a compound-wound machine, the motors being connected in series. The speed of the vehicle may be varied from 2 to 15 miles per hour. In addition to speed control by throttling the engine, a controller is provided giving two forward and two reverse speeds and for cutting in an electric brake. A low speed in either direction is obtained by placing the motors in series across the

FIG. 4.—ELECTRIC VEHICLE BEING CHARGED FROM PORTABLE STATION.

generator leads with a resistance in circuit. The high speed in both directions is obtained by running the motors in series without the resistance. The outfit is very efficient, the amount of gasoline consumed in driving the vehicle to Belmont Park, Long Island, and charging batteries for one hour being only six gallons.

Twelve charging plugs are provided with flexible leads of sufficient length to accommodate as many vehicles. These plugs

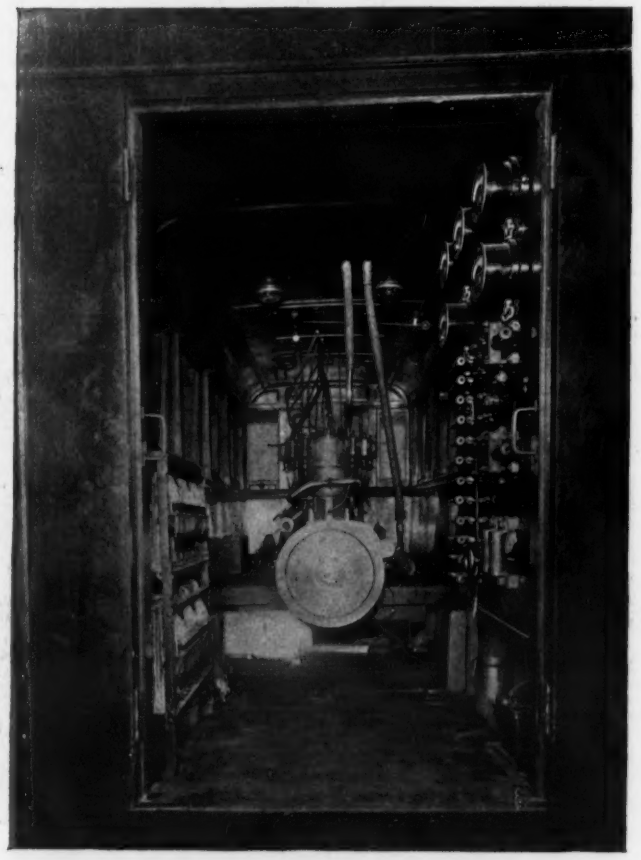


FIG. 5.—REAR END OF PORTABLE CHARGING STATION.

are carried in boxes on the roof of the car, six on each side. The plugs are connected to the switchboard, which is equipped with 12 single-pole, double-throw switches, one for each charging circuit. When the switch is thrown to the right the plugs are connected to the main bus-bars, when the switches are thrown to the left, the circuit is made through an ammeter shunt in order to make it possible to take readings of the current supplied to the batteries. The twelve charging plugs are divided into two groups by means of a double-pole, double-throw switch, and the groups may be connected in series or in parallel for operation on 220-volt or 110-volt circuits. A double-pole, double-throw switch is provided to connect the generator either to the charging bus-bars or to the vehicle motors. Ammeters and voltmeters and a field rheostat are mounted on the switchboard. To regulate the charging current in each of the charging circuits, considerable resistance is provided. The resistance coils are mounted opposite the switchboard at the rear end of the car. The interior of the charging station is equipped with four 8-cp dome lamps fed from a battery beneath the body of the vehicle. When not shut down for any length of time the engine is usually self-starting on spark, otherwise a starting level is used.

The weight of the entire outfit with all supplies is 16,000 lb. Little odor can be detected and the operation is almost noiseless. The plans for the vehicle were completed on March 1 and the outfit was ready for operation at the opening day of the spring meeting at Belmont Park, remaining in daily operation throughout the meeting. The vehicle was constructed from an old double-deck omnibus which was lengthened three feet. The entire fittings were removed and new running gear, motors, steering gear, etc., provided. The engine bed is made of structural iron well supported. The whole outfit was gotten together hurriedly and the most available material used so as not to delay the work. This accounts for the presence of a marine engine not entirely suited for the work. The equipment has been giving very good service, however, and the company feels a pride in its operation. Mr. Palmer, the engineer for the New York Transportation Company, is responsible for the design.

Ramsey Crank Mechanism.

An interesting crank mechanism has been invented by Robert H. Ramsey, of Philadelphia, having for its purpose to increase the efficiency (thermal, mechanical and total) of single-acting engines, and particularly of internal combustion engines. In ordinary engine design the crank shaft is placed in line with the central axis of the cylinder and the connecting rod is usually made approximately five times the length of the crank. To make the connecting rod shorter with the ordinary crank mechanism

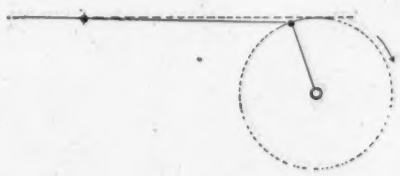


FIG. 1.—DIAGRAM OF CRANK RELATIONS.

introduces excessive cylinder friction because of the sharp angularity of the connecting rod during the power stroke. The Ramsey crank mechanism comprises a connecting rod made approximately three and three-eighths times the length of the crank, and a crank of ordinary design with the shaft located from the central axis of the cylinder a distance equal to the length of the crank. (See Fig. 1.)

The first notable effect of this disposition is to increase the length of the piston stroke and to increase the proportion of the crank circle during which effective pressure is applied to the crank. Thus in Fig. 2 AB and BC represent the positions of an ordinary connecting rod and crank at the beginning of the power stroke; DE and EC represent the positions of the same connecting rod and crank at the end of the power stroke. AD, therefore, represents the piston stroke, which is equal to the diameter of the crank circle. During this stroke the crank covers exactly one-half of its circle, or 180°. In the same figure AF and FO, illustrating the Ramsey mechanism, represent the positions of the connecting rod and crank at the beginning of the power stroke; and HG and GO represent the positions of the same connecting rod and crank at the end of the power stroke. AH, therefore, represents the piston stroke, which ex-

ceeds by about 5.25 per cent the diameter of the crank circle, while the crank pin has been driven from *F* to *G*, a distance which equals 192° of the crank circle, or 12° more than one-half the circle.

The effect of the longer piston stroke is to increase the expansion of the gases, which not only increases the power to be obtained from an engine, but also the efficiency and economy with which it is operated. The gain in effective crank travel similarly increases the power that can be obtained from an engine of given dimensions.

In the case of the ordinary crank mechanism, no angular relation exists, at the inner dead center between the connecting rod and the central axis of the cylinder, and therefore the only friction between the piston and the cylinder is that due to the weight of the piston itself. Immediately after passing the inner dead center, however, the connecting rod assumes an angular relation to the central axis of the cylinder which increases very rapidly, and since the friction between the piston and the cylinder wall is the result of the angular thrust exerted by the connecting

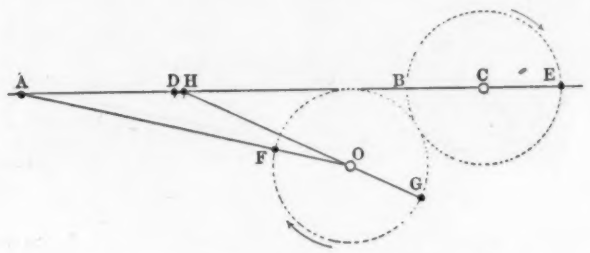


FIG. 2.—COMPARISONS OF STROKE LENGTHS.

rod, therefore the greater the angularity—pressure and velocity considered—the greater will be the friction.

Comparing this with the angularity existing between the connecting rod and the central axis of the cylinder in the Ramsey crank mechanism, as shown in Fig. 3, at the inner dead center in which position the connecting rod is shown as *A B*, the angularity equals 13°. As the piston travels outward on the power stroke, this angularity rapidly decreases, instead of increasing as in the case of the ordinary crank mechanism. For example, when the connecting rod reaches the position shown as *C D*, after 30° of crank travel, the angularity has decreased to 5°; in the position *E F* it has decreased to 1°, while between the points *E* and *J*, when the piston is traveling at its maximum speed and the crank is in the most favorable position for transmitting the power delivered to it, the angularity is practically zero, and a straight thrust is obtained through a considerable portion of the stroke. In the succeeding positions, *G H*, *J K* and *L M*, the existing angularities are, respectively, ½°, 4° and 11°. In the position *N O*, at which point the crank has traveled one-half its circle, the angularity has increased to 21°, while at its outer dead center, shown as *P Q*, the angularity is 25°; but at these late points very little friction is caused by the greater angularity since but comparatively slight pressure is exerted on the piston and the distance traveled by the piston is small.

Fig. 4 shows graphically in another form the extent of piston travel with different degrees of angularity. In this figure the upper line represents the piston stroke of an engine equipped

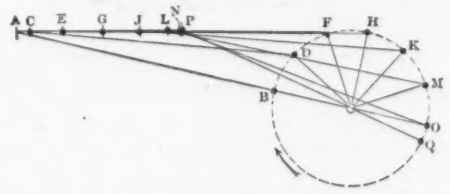


FIG. 3.—ANGULARITY OF PISTON ROD.

with the Ramsey crank mechanism. The lower line represents the piston stroke of an engine equipped with the ordinary crank mechanism, both engines having the same length of crank. The lines *A* and *A'*, *B* and *B'*, *C* and *C'*, and so on up to and including *L* and *L'*, represent the respective positions of the two pistons at intervals of 15° of crank travel. *M* represents the position of the piston of the engine equipped with the Ramsey mechanism after 12° of further crank travel, i. e., at the end of the power stroke. Above the lines *A*, *B*, *C*, etc., are given the degrees of angularity existing between the connecting rod and the central axis of the cylinder of the engine equipped with the Ramsey crank mechanism when its piston is in these respective positions. Below the lines *A'*, *B'*, *C'*, etc., are given the angularities existing between the connecting rod and the central axis of the cylinder of the engine equipped with the ordinary crank mechanism when its piston is in these respective positions. This figure shows that only at the extremities of the stroke does the angularity of the ordinary mechanism compare favorably with that of the Ramsey crank mechanism. From the positions *B* and *B'* to the positions *I* and *I'*—which include by far the greater part of the stroke—the latter shows an overwhelming advantage in connecting rod angularity over the ordinary mechanism.

The following table compares the travel of the two pistons on a percentage basis, which holds good for any length of crank:

Power Stroke Piston Travel.	Ramsey Crank Mechanism. Per cent.	Ordinary Mechanism. Per cent.
Less than a 10° angle.....	88	50
" " 9° "	85	30
" " 6° "	73	13¼
" " 3° "	50	3¼
" " 1° "	31	1¼

A noteworthy feature of the Ramsey crank mechanism is the

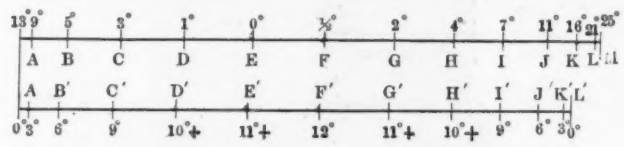


FIG. 4.—GRAPHICAL REPRESENTATION OF PISTON TRAVEL.

sluggish movement imparted to the piston at the beginning of the return stroke. In Fig. 5 the distance *A B* represents the piston stroke of an engine equipped with the mechanism, and the line *A C* represents the part of the stroke that would correspond to the full stroke of an ordinary engine having the same length of crank. From the time the piston passes the point *C* on its outward stroke and returns to this point on the return stroke, the crank travels from the point *E* to the point *F*, a distance equal to 60° of its circle, or one-sixth of its entire path. This sluggish movement of the piston makes it possible to exhaust the burned gases with considerable less back pressure than that which is inevitable in an ordinary engine, and overcomes the objections to the use of an auxiliary exhaust port, from the necessity with the ordinary crank mechanism of sacrificing a part of the power stroke for the operation of the auxiliary port. In the case of a two-cycle engine the sluggish movement presents the further advantage that less of the power stroke need be sacrificed by the opening of the exhaust port, while at the same time there is a greater period for voiding the exhaust gases, and thus enabling the engine to be run at a higher speed.

An interesting feature of the new crank mechanism is that it can be adapted to any single-acting engine of present design without in the least interfering with the special features of such an engine. It adds no new parts to an engine and involves no complications. On the other hand, it reduces the cost of the connecting rod forging, and, by shortening and compacting the engine as already pointed out, it reduces the weight of the engine

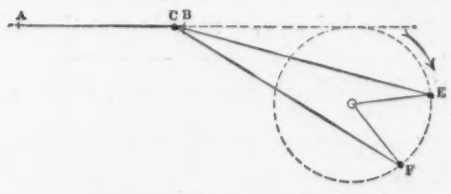


FIG. 5.—SLUGGISH MOVEMENT OF PISTON.

and the amount of metal required for the engine frame.

For the purpose of making a comparison, an engine was constructed and equipped with the Ramsey crank mechanism on the lines of a well-known vertical marine gasoline engine, of the four-cycle type, having a 9½ by 14-in. cylinder (Fig. 6). The manufacturers claim for their engine a fuel consumption of ⅛ of a gallon of gasoline per horse-power-hour, while in the tests made of

the engine equipped with the Ramsey crank mechanism the fuel consumption was found to be from 1/10 to 1/11 of a gallon per horse-power-hour.

In a series of tests made of this engine under the supervision of the University of Pennsylvania, working under brake loads varying from 22 to 30 hp, the total efficiency of the engine ranged from 24.1 per cent to 25.9 per cent. These figures refer to the total heat efficiency, i. e., the ratio between the total heat supplied to the engine and the heat accounted for in useful work. This compares with a total efficiency of approximately 19 per cent for the engine equipped with the ordinary crank mechanism after which the test engine was patterned. So far as is known the results obtained in these tests greatly exceed the results

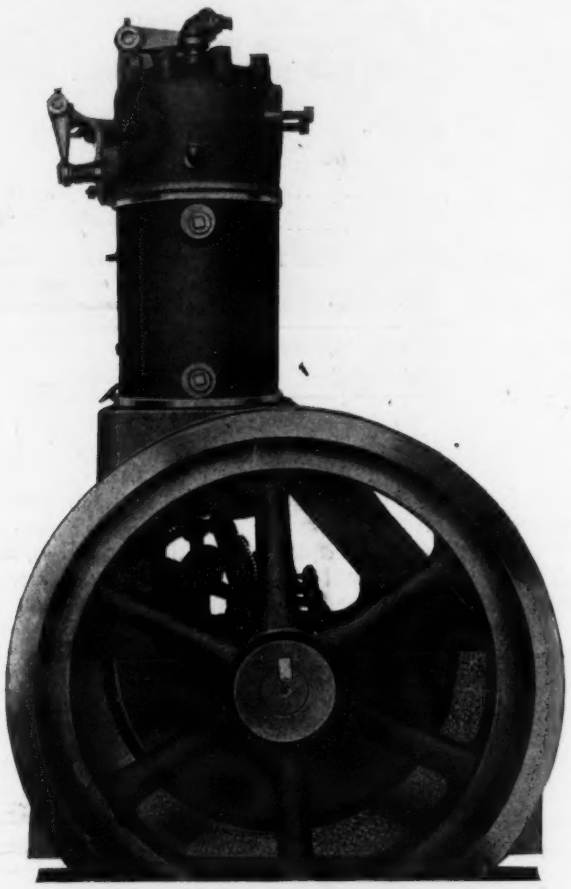


FIG. 6.—MARINE GASOLINE ENGINE.

obtained from any other gasoline engine of anything like similar size. Moreover, to whatever extent the efficiency of an engine may be improved by changes in the design, without reference to the crank mechanism employed, this efficiency can still be increased by the Ramsey crank mechanism, through the increased expansion incident to the mechanism, the greater piston stroke and crank effort, the decreased friction, the sluggish movement and quick compression, etc.

The domestic patents of the Ramsey crank mechanism are controlled by the Ramsey Engine Company with offices in the Bullitt Building, Philadelphia, which company issues licenses to manufacturers of single-acting engines in this country.

Water-Tight Telephone System for Battleships.

The following description and illustrations relate to the special telephone system designed and built by the Holtzer-Cabot Electric Company, Boston, Mass., for the Naval Department of the United States Government. Five similar systems were purchased by the Government and installed upon the following battleships: *California, South Dakota, Milwaukee, Indiana* and *Connecticut.* To meet the specially severe conditions which obtain on shipboard there were incorporated a number of novel and original features. It was especially desired that the instruments be unaffected by the action of the air, the movement of the vessel, or the concussion of the heavy guns, and the switchboard and exposed stations were to be absolutely water-tight.

Fig. 1 represents one of the water-tight stations. The operating parts are mounted on a frame plate which can be readily removed from the case without the use of tools and without disturbing any of the connections. One of the distinctive and original features of this station is the double receiver, the two receivers operating independently of each other, so that either or both may be used. The act of raising one of them to the ear brings the transmitter into the proper position for talking and signals the switchboard. When released all parts return to their normal condition, making it impossible for any user to leave the

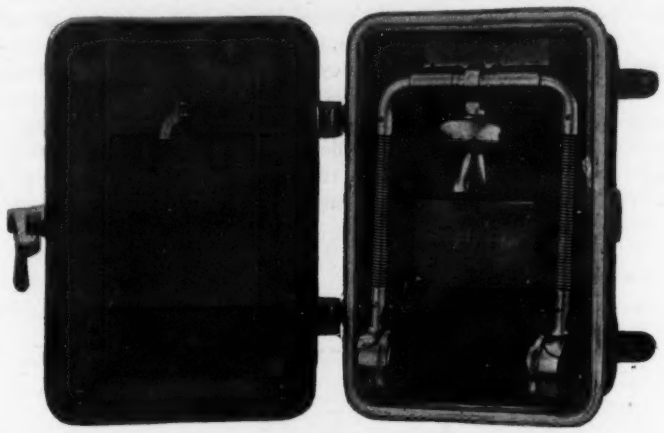


FIG. 1.—WATER-TIGHT TELEPHONE STATION.

telephone connected to the line. The receivers are of the watch-case type, double pole, with metal cases, the coils being specially treated to make them waterproof. The transmitters are of the solid-back type, the chamber being hermetically sealed, there being used nothing that will be affected by the moisture. The arms will support a weight of 200 lb. The case which encloses the station is of composition, polished and oxidized and provided with a channel into which is fitted a molded gasket of pure rubber. The non-water-tight stations (Fig. 2) are interchangeable with the water-tight 'phones, the operative parts being mounted upon a mahogany base instead of in a metallic case.

With each station there is furnished a separate water-tight vibrating call bell. The design of the mechanism of this bell is distinctly special, the blow being delivered to the gong through

FIG. 2.—NON-WATER-TIGHT STATION.

a phosphor-bronze diaphragm, which is reinforced so that there is no danger of its being worn through by use. The parts of the bell are made of non-oxidizible metal with the exception of the iron and steel parts, which are copper-plated and lacquered to prevent corrosion.

The operative parts of the switchboard are mounted in a heavy brass case, shown in Fig. 3. This is gasketed so that when the cover is closed it is absolutely water-tight. The case is divided into two compartments, the upper containing the terminals and the lower the switchboard proper. The upper part of the case is drilled for 2-in. conduits. The terminals are of heavy copper lugs and are insulated with mica. A distinguishing feature of the board is that the connections are made without cords, there being used specially designed keys instead. The front of the

switchboard is subdivided into vertical strips, each holding four keys. By taking out two screws any one of these strips may be removed, exposing for examination every contact and connection on the strip. The whole front which supports the case and signals is hinged at the bottom, so that it may be readily let down, allowing the cables to be examined. A supervisory signal is provided with each connecting circuit, the purpose of which is to indicate when the conversation has been finished.

Current for the transmitters is taken from a Holtzer-Cabot

FIG. 3.—SWITCHBOARD.

motor-generator of the noiseless type. These circuits draw their current directly from the motor-generator, there being no storage batteries. The ringing current is obtained from the ship's ringing dynamotor, or in case of disability from an emergency set of dry batteries. The system operates on a three-wire circuit and five conversations can take place at the same time, or any number of stations can be connected and an order transmitted simultaneously to them from any other station.

A Simple Electrical Voting Machine.

The process of ballot voting at small meetings is often quite tedious and tiresome, and is not always surrounded by the secrecy that it is desirable to preserve. Dr. S. S. Wheeler, president of the American Institute of Electrical Engineers, has on behalf of

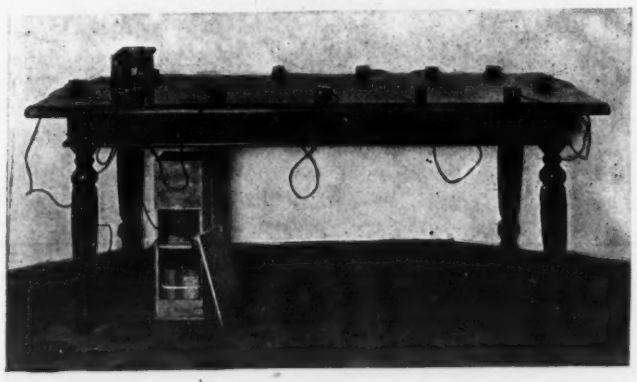


FIG. 1.—VOTING APPARATUS.

the Automobile Club of America, of whose building committee he is chairman, devised a new and simple apparatus for the club, intended to take the place of the customary ballot boxes with which white and black balls are used. Not only is this latter method somewhat laborious, but unless considerable pains are taken, the entire secrecy of the ballot is not assured. Also where many membership applications are to be voted upon, some better and more rapid scheme is desirable.

As shown in Fig. 1, it is arranged at a table around which the board of directors or other voters are seated, and consists of an ordinary two-drop annunciator operated by dry batteries. On each of the pushers arranged around the table there is a white button on the side and a black button on the end, the former operating the white drop and the black button the drop on which a black circle is shown. If any one of the black buttons is pushed, the black drop will fall, but if white buttons only are pressed the white drops only will come down.

In operating the shield on top of the annunciator is lowered to cover its face and all votes can be cast at the same instant. On raising the shield the result is at once known. The case consists of three compartments, in the lower one of which

FIG. 2.—VOTING APPARATUS IN CARRYING CASE.

batteries are located. When packed for carrying or storage (see Fig. 2), the annunciator is in the middle compartment, and the cord and pushers on the top.

Machinery in Southern Granite Cutting.

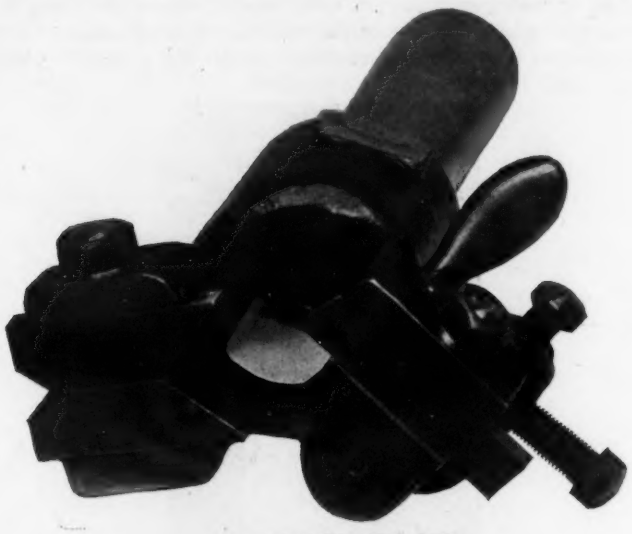
Mt. Airy granite from the quarries of the North Carolina Granite Corporation, has, in the last three years, come into competition with the famous product of New England quarries in all the big markets, and with that of the Georgia quarries in the furnishing of street paving material. Very substantial buildings have been constructed at Mt. Airy for the various operations of quarrying. The new stone cutting plant is 300 by 65 ft., and will be extended 300 ft. This plant is supplied with an electrical crane of 25 tons capacity, 16 surfacing machines and an equipment of various pneumatic tools of all kinds. The main boiler plant has an aggregate capacity of 420 hp. An Allis-Chalmers generator direct-coupled to a high-speed engine, and having a capacity of 100 kw, furnishes the power for crane and surfacing machines, and will later be used to operate independent machines in the machine shops, etc. There is absolutely no waste product from the quarry due to the operation of a rock crusher through which all waste is passed. This machine is a No. 4 Allis-Chalmers (Gates) breaker, which has been in steady operation since 1898, when it was installed there by the original developing company. The product from the machine is sold for railroad ballast, concrete material and kindred uses.

New Finishing Box Tool.

The user of the common round turret screw machine has no doubt often wished that he could use the adjustable turning tools seen on the flat and hexagon turrets. The Garvin Machine Company, New York, is now making a new form of box tool which is claimed to make available for the ordinary round turret all the advantages of the rocking overshot tools, used so successfully on flat and hexagon turret lathes.

Among the advantages of the tool are that the cutting tool being overshot or tangent to the work, is a free and rapid

cutter. The adjustable jaws admit of producing a burnished effect that leads to smooth work. The rocking tool holder controlled by the cam handle allows the cutting edge to be cleared from contact with the finished work, while the machine is running, and so avoids all marking of the work. The rocking construction also permits of relieving or turning work smaller for a certain distance between the ends. The tool can be set up for size much quicker than the fixed form of tool. The matter of making ready quickly is a very important one on short jobs and

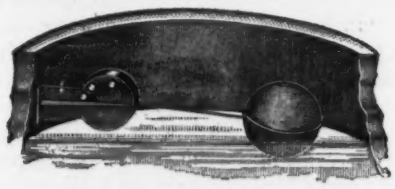


FINISHING BOX TOOL.

reduces materially the total cost of a limited number of pieces. The cutting tool can be set to precede or to follow the steady jaws, and can, therefore, be used on rough stock as well as cold rolled stock, and as the steady jaws are adjustable, no collection of different sized steady bushings are required. The tool is made in several sizes to turn up to 2 in. diameter 4 in. long.

Tank Electric Alarm.

The accompanying illustration shows an electrical tank alarm, made by the Jones Electrical Company, New York, and exten-



TANK ALARM.

sively adopted in connection with sprinkler tank systems. The illustration indicates very clearly the details. The alarm is in a local circuit with the alarm bell usually in the watchman's or engineer's department.

American Ball Engines and Dynamos.

The American-Ball Engine Company, Bound Brook, N. J., is specializing in the construction of complete generating sets. Among its types of engines for electric drive is a duplex compound type, which is claimed to possess advantages not found in either the tandem or cross-compound types, the chief among which is compactness, the engine occupying no more floor space than a simple engine of less power. The high and low-pressure cylinders are cast together—one directly below the other. One cross-head carries both piston rods while a single, continuous valve of an improved design controls the admission and exhaust in both cylinders. The admission and exhaust are simultaneous in both cylinders, thus securing an even distribution of the work between the two pistons.

The inertia governor is one of the chief characteristics of the American-Ball engines. It maintains a speed regulation within one-tenth of one per cent from no load to full load suddenly applied. A continuous oiling system is provided which does not depend upon the splash principle, but is positive in its action.

The design of the dynamos conforms with the most approved principles of modern practice. Special attention has been devoted to the matter of armature ventilation. This is one of the most important questions which confronts the dynamo designer and constructor, as armature heating is always accompanied by an unavoidable increase in resistance, loss of efficiency and loss of generator capacity.

Heating is kept as low as possible by a single large air duct, dividing the armature, transversely, into halves. This acts like a centrifugal blower drawing a great volume of fresh air through the armature and giving a thorough ventilation to the machine. Another item in the maintenance of low armature temperature is the formation of the coils. These being of solid bar copper, wound with cotton and thoroughly insulated, allow a greater cross-section of copper (and thus larger conductors) to be put in the slots than where the more bulky tape-wound wire coils are used. In this manner a greater current-carrying capacity is obtained with less resistance and therefore less heating under load.

Series Current Tap.

It is often desired to obtain from an incandescent lighting circuit a current of limited capacity, which can usually be done by using, instead of a rheostat, a lamp of from 8 to 50 cp as a resistance. With the series current tap shown in the accompanying illustration, this can be done by merely screwing the attachment into any lamp socket, and using a lamp corresponding to the current desired. The device is also designed for use in connection with fan motors, since if the speed of a motor is

CURRENT TAP.

stepped down by the rheostat at the base of the fan, the resistance coils frequently burn out and are more or less troublesome. A series current tap placed in circuit will reduce speed of fan without deterioration to the rheostat. By placing an 8, 16, 32 or 50-cp lamp in series the speed can be controlled without danger of either overheating armature or resistance coils. The fan runs smoothly and noiselessly for an indefinite period without depreciation. The device, which is known as the Vetter series current tap, is made by E. B. Meyrowitz, 104 East Twenty-third Street, New York.

Larger Power Plant for Pittsburg Trolleys.

Almost 30,000 additional horse-power in boilers, engines and electrical machinery will be added to the great Brunot's Island power house of the Pittsburg Railways Company this year. Contracts were closed this week and involve considerably over $300,000 in investment. There lately have been tremendous demands for power upon this plant because of the extension of lines in all directions, not only in the two cities, but throughout the sub-

urban districts. The company, when it built the big plant on Brunot's Island, arranged for increasing the plant to 50,000 hp. With this additional power the plant will contain practically that capacity and there is a likelihood that it will be again increased in the future. The new equipment contracted for consists of three turbine engines of 7,500 hp each and one of 5,000 hp, making a total of 27,500 hp. Besides this there will be the additional boiler capacity, electric generators, switchboard and wiring.

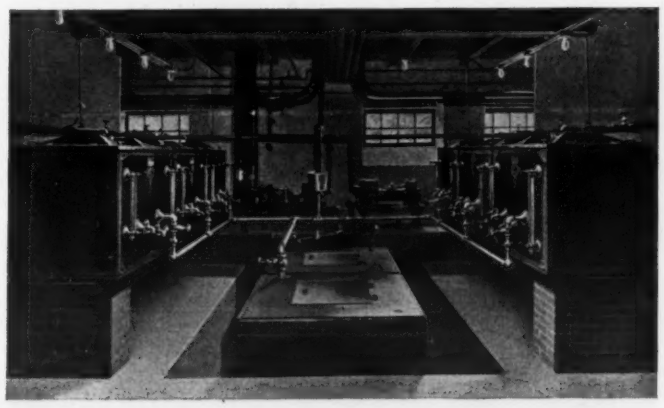
The initial installation of turbine engines by this company makes it one of the most important orders in the country. Pittsburg is at present the slowest to take hold of the new power method and this installation is the first of importance in the city. The Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company have the orders for the entire contract. The additional power will be used not only for the new traction lines to be ready for operation soon, but for lighting purposes as well.

The new suburban line from Pittsburg to Canonsburg and then to Washington, Pa., will be completed this year and will demand more power, while the expansion of the city lines in many directions all call for additional power. In these additions the plan is to transmit the power over high-tension wires from the power house to distributing points, where it will be reduced in voltage to the requirements of the service. The power will go out of the power station in the form of an alternating current and be transformed to a low voltage direct current for car service.

When the Brunot's Island power house is fully equipped it will be one of the largest of its kind (steam) in the world. Fuel for this plant will come almost exclusively from a coal mine owned by the Pittsburg Railway Company adjacent to Brunot's Island, and which will give the company plenty of coal at practically the cost of mining. The fuel arrangements give the company quick handling of coal and the ashes from the boiler are being used to fill up the low parts of the island, thus reclaiming them for commercial purposes. The total cost of this great plant will be close to $2,000,000.

Oil Filtering System in the Mt. Vernon Street Power House of the Philadelphia Rapid Transit Company.

The Philadelphia Rapid Transit Company has recently installed in its power house at Thirteenth and Mt. Vernon Streets six American "Unit" filters built by the Burt Manufacturing Company, of Akron, Ohio. These filters have cleaned as high as 2,000 gallons of oil in 24 hours, although the extreme capacity



SIX "UNIT" FILTERS.

claimed by the builders for six units is only 1,350 gallons. The generating equipment at this station consists of five Wetherill-Corliss engines driving as many 1,500-kw Westinghouse direct-current generators. The oil from all of these engines is filtered and used over again, thus resulting in good lubrication and economy as well. In the system employed the oil is fed to the bearings by gravity from an overhead oil reservoir. After passing through the bearings it is piped to the oil filters in the basement and after being filtered is again pumped back to the reservoir. In the process of filtering the dirty oil enters the waste oil receptacle and passes through small perforations to two filtering cylinders. In passing to these cylinders the heavy impurities fall into a sediment pan and therefore do not clog up the filtering cloths wrapped around the filtering cylinder. After passing through a quantity of bone black the oil finds its way through two tubes to the bottom of the filter. Here it is spread out by means of plates in very thin films and thoroughly washed by water. In the upper part of the filter is a hot water chamber where the oil is heated. This, of course, causes it to flow more freely through the filter and increases the capacity of the unit. It also suffices to precipitate much of the dirt and grit in the oil.

In the construction of the filter the body is riveted to a heavy wrought-iron frame. All seams are lapped, riveted and soldered, and both the upper and lower parts are made of cast iron. Any kind of filtering material may be used in the cylinder, such as white waste, sponges, excelsior, raw wool, etc., but animal bone black is thought to give the best results. The filtering cloth is easily removable and when cleaned may be used over again. Each unit of the system is so constructed that it can be used in connection with or independently of, an oiling system, so that in case of additional machinery being added to a power plant, any number of units may be added to take care of the additional oil without any change in the piping.

An Improved Oil Gauge.

A unique design of oil gauge for use on dynamos and other machinery having self-oiling journal boxes, has lately been placed on the market by The Lunkenheimer Company, of Cincinnati, Ohio. The gauge glass is protected by a metallic shield, free to turn, having two oblong slots, through which the height of oil can be seen. One of its features is the easy cleansing of the glass, which is accomplished by simply placing a piece of waste against the glass tube and revolving it with the shield. The fact that the shield can be revolved makes it possible to observe the height of oil in the gauge (no matter in what position the observer may be standing in respect to the gauge) by simply turning the shield until the glass can be seen through one of the slots. The principal feature, however, is the improved construction of the ground key located in the bibb-nose body. Turning this key to the right, by means of the small handle attached directly below the shield, makes it possible to drain the shield independent of the journal box oil receptacle; or, by turning the key in the opposite direction, both the gauge and the oil receptacle can be drained. By placing the handle parallel with the bibb-nose drain, the gauge will register the amount of oil in the journal box oil receptacle and the drain is closed. It

OIL GAUGE.

will therefore be seen that, should the gauge glass be broken, the oil can be drained therefrom, without necessitating the drainage of the oil from the journal box oil receptacle, and the glass can immediately be replaced. A wrench applied to the small hexagonal nut at the top of the gauge makes it possible to remove the gauge glass, as it and the shield are simply held in place by a rod running through the center of the gauge and screwed into the key. The gauge, which is known as the "Triplex," is made by the Lunkenheimer Company.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of crop developments and of trade and industry continue favorable, and the optimistic feeling with regard to fall and winter business grows stronger. In the leading industries, seasonable activity of unusually large proportions is the rule, with the iron and steel trades leading in volume of demand and output. Building operations are extensive, and, it is thought, would be much greater if the cost of labor and material had not caused the abandonment of many plans. The crop situation seems to lose nothing as the growing season advances. Estimates of total wheat yield tend to grow as the spring wheat crop approaches maturity. A bumper yield in the Northwest is thought not impossible; corn is doing well, with a record Southern crop in sight. Too much rain for cotton in the eastern half of the belt has induced some cancellations, but these are said to be no more than are normally experienced. The heavy movement of winter wheat to market, while tending to some ease in prices, has a favorable side when the export business is considered. Reports are that a large future business in this direction has already been booked. Railway earnings in July thus far surpass corresponding reports for last year by 8.5 per cent, and foreign commerce at the port of New York alone for the last week shows gains of $2,110,472 in exports and $1,589,518 in imports. Midsummer buying of iron and steel are far above the average for July in preceding years. Foundry iron is more active at the West, and prices at Chicago have advanced 25 cents a ton, and the general tendency at all markets is toward higher figures. Remarkable activity at shipyards on the Great Lakes develops a rather large business in plate and structural materials, in addition to which heavy contracts for bridges and buildings continue to be placed. Orders for steel rails are still of remarkable volume, considering the heavy business heretofore booked, the week's contracts, domestic and foreign, probably aggregating 125,000 tons. Cuba, South America and Japan took, between them, upward of 25,000 tons. Railways are free buyers of track supplies and continue to contract for cars. Wire and wire products usually experience a lull in July, but this year business has been surprisingly active. Old material shows a better tone. Copper is higher on better demand, domestic and foreign. The market is immovably firm for refined grades, based upon the certainty that the world's production is at present hardly commensurate with the consumption. Last week's sales in the local market amounted to a very large tonnage in electrolytic sold to foreign and domestic wire-drawers and the electrical trades. None of these sales of prime metal was made at less than 18½ cents, tidewater delivery during September and October. Lake is firm at 18¾ to 18⅞c. for October. Casting copper, prime brands, thirty days, is 18¼ to 18½c. for large tonnage. Aluminum No. 1 bars is quoted at 36c., nickel, 45 to 65c. One hundred and seventy-one business failures is the record for the week ending July 26, as reported by *Bradstreet's*. In the corresponding week last year there were 197. Last week's figures are 17 less than those of the week previous.

INDUSTRIAL TURBO-GENERATOR PLANTS. — The Union Portland Cement Company, Ogden, Utah, has ordered two 1,200 kw Westinghouse-Parsons steam turbines for its plant at Portland, Utah. The turbines will operate on 175 pounds steam pressure, 27-inch vacuum, and no superheat, driving enclosed type turbo-generators delivering 480 volts at a frequency of 30 cycles to a three-phase distribution system. The turbines will operate twenty-four hours per day generating current for motor-driven machinery throughout the mill and electric locomotives operating between the quarry and the mill. A 750-kw Westinghouse-Parsons turbine is destined for the Pittsburg Reduction Company's plant at East St. Louis, Ill., operating non-condensing on a steam pressure of 150 pounds. The California Powder Works have added another turbine to their plant at Pinole, Cal. This machine runs parallel with a 400 kw Westinghouse-Parsons unit already installed at the plant and through static transformers with 250 kw reciprocating engine units, with which the present 400 kw unit is now operating successfully. This turbine has made a remarkable record for itself. Starting on July 27, 1905, it has operated continuously for nearly a year with but one shut down for the purpose of inspection.

LINK-BELT CONSOLIDATION.—The Link Belt Company, of Chicago, under its new name, has purchased the plants of the associate companies and will maintain the offices and operate the manufacturing plants now established. Mr. Charles Piez, the president, says: "Our consolidation is the result of the purchase by the Link Belt Machinery Company, of Chicago, under its title of Link-Belt Company, of the plants, assets and good will of its two associate companies, the Ewart Manufacturing Company, of Indianapolis, and the Link-Belt Engineering Company, of Philadelphia. These three companies have always been controlled by the same capital; and the consolidation simply meant the substitution of a single organization for the three separate organizations maintained heretofore. The general feeling among our customers has always been that the three companies were one." It will be remembered that some time ago the Philadelphia house took under its control the United Telpherage Company, doing a large business in the handling of material by electric motor travel overhead; so that the new concern is very strong at both the mechanical and the electrical end of "subdivided" transportation of freight, coal, etc.

PLANT FOR STEEL WORKS.—The Carnegie Steel Company has purchased for its Homestead works two 2,000 kw alternating current generators driven by gas engines. These units are to be furnished by Allis-Chalmers Company, of Milwaukee, and they complete an order recently given for machinery costing approximately one million dollars for the Homestead plant. It includes three gas engine driven electric units and four gas blowing engines, the aggregate capacity of these machines being nearly 30,000 hp. This follows close upon the recent million dollar order given to the Allis-Chalmers Company by the Indiana Steel Company for the electrical equipment of its new plant at Gary, Ind., where gas engines of the same type and capacities, operating on waste gas from the blast furnaces, are to serve as prime movers for electric generators supplying current to the steel mills. Other purchases of gas blowing engines and gas engine driven electrical units made from the Allis-Chalmers Company amount to practically a million dollars more, so that sales during the past few months have aggregated three million dollars.

CROCKER-WHEELER ORDERS.—The following list of six recent sales by the Crocker-Wheeler Company, of Ampere, N. J., shows that the company's customers are not confined to any one industrial line. In this short list of sales are represented a textile mill, a coal and coke company, Haverford College, general manufacturers, a zinc company and a powder company. The sales include electrical machinery of the following capacities: Allentown Spinning Company, one 60 kw direct current engine type generator, 125 volts, 675 r.p.m.; Northern Coal & Coke Company, one 80 kw direct current generator, 250 volts; New Jersey Zinc Company, four motors ranging from 10 to 35 hp; Haverford College, one 125 kw, engine type, alternating current generator, 2,300 volts, 60 cycle, three-phase, 257 r.p.m.; Mohawk Valley Cap Company, one 300 kw direct current generator, 480 volts, 150 r.p.m., one 18 kw direct current generator, 125 volts, 170 r.p.m., and two motors ranging in hp from 10 to 75, all of 440 volts.; E. I. DuPont Company, one 130 kw direct current generator, 550 volts.

LIGHTING AT ALEXANDRIA, VA.—In connection with the granting recently of a thirty-year lighting franchise at Alexandria, Va., bids were submitted by Messrs. Weller & Cockeral and Messrs. Howell & Sinclair, of Washington, Mr. E. E. Mandeville, of Philadelphia, Mr. B. F. W. Bryant, of Boston, and Mr. C. H. B. Chapin, of New York. The matter was referred to committees by the city council, and Mr. Hugh Hazleton, of New York, was retained as consulting engineer. He recommended Mr. Mandeville's bid as being the most advantageous to the city and his report was unanimously approved by the committee. The question was referred back to the council on July 24, and after some discussion the franchise was awarded to Mr. Mandeville. The franchise is for, as stated, thirty years, and carries a thirty-year street lighting contract for at least 88 arc lamps.

WESTINGHOUSE IN SWEDEN.—The Strangen-Wick Railway Company, which operates a suburban line near Stockholm, Sweden, has contracted with the Westinghouse Company, of Pittsburg, for the electrical equipment of its cars. This sale is the result of a test instituted by the Swedish government about a year ago.

INDIANA TROLLEY EQUIPMENT.—A new line of trolley, that of the Indianapolis, New Castle & Toledo Railway, is no less than 140 miles long. The engineering features of the road include the building and equipment of a main power station, located near New Castle, and ten permanent and one portable sub-stations, one sub-station being installed in the main power plant building. The main power station will contain units of 1,000 kw each, two Allis-Chalmers steam turbo-generating units being installed for present use to supply 25-cycle alternating current to the line by a system of step-up transformers operating at 33,000 volts. All transmission, both high-tension and railway service, will be carried on pole lines, no third-rail construction being considered advisable. Seventy-pound A. S. C. E. Section T rails heavily ballasted, will permit of high-speed train operation. An express service is allowed for, as well, and two 50-ton electric locomotives will be provided for freight haulage and switching purposes. The contract for the entire construction of buildings and road bed has been awarded to the Electrical Installation Company, of Chicago. Complete Allis-Chalmers power and electrical equipment will be installed in the main power station and three rotary converter sub-stations, which will be built at once, the building of the remaining sub-stations being delayed until later. The equipment for the main power station will, for the present, consist of two 1,000-kw Allis-Chalmers turbo-generators to operate at 175 lbs. steam pressure and 50 deg. F. superheat, the electrical ends of these units being wound for 25 cycles, three-phase, 2,300 volts. The boiler equipment will be made up of three horizontal water-tube boilers, 175 lbs. gauge, with nominal rated capacity of 400 boiler horsepower each and fitted complete with mechanical stoking devices. Two boiler feed pumps are provided, of the horizontal outside, center packed plunger type. A feed water heater of the open cast-iron type will be provided, capable of handling 45,000 lbs. of water per hour. Two complete surface condenser equipments will be furnished, consisting of condenser proper, steam-driven air pump and centrifugal pump, direct-connected to a simple engine, each outfit capable of condensing 20,000 lbs. of exhaust steam per hour. Two exciter generators will be furnished, one for each of the 1,000-kw turbo-alternators. Six 350-kw oil-filled, water-cooled, step-down transformers for a ratio of 2,300 to 33,000 volts, are provided. They are to be arranged in two banks of three each for connection to the alternators. Three converter transformers, each 150-kw, oil-filled, self-cooled, step-down type for 33,000 to 405 volts will be provided for supplying current to the 400-kw compound-wound, Allis-Chalmers rotary converter to be installed in the main power plant, 40 kw, 25 cycles, 405 volts, alternating current, 650 volts, direct current. A 40-kw, 120-volt direct current generator provided, for direct connection to a high-speed engine, will be so connected as to form a reserve and furnish the station lighting. The outside sub-stations will each be provided with a 400-kw, 25-cycle, three-phase Allis-Chalmers rotary converter and three 150-kw, oil-filled, self-cooled transformers, similar to those already described. Eight complete Allis-Chalmers car equipments will be provided, each consisting of four 75-hp railway motors, two controllers, Christensen air-brakes, one set of rheostats and miscellaneous apparatus. The controllers which have been developed for use with these motors, are made suitable for two and four-motor equipments. They are of the series parallel type and are provided with an efficient magnetic blow-out.

TELEPHONY IN MASSACHUSETTS.—With regard to the effort to establish opposition telephony in Boston, Mr. T. Sherwin, president of the New England Telephone & Telegraph Company, said: "It is my opinion that it is impossible to use the automatic system in a large exchange like Boston, where thirty-eight municipalities have to be interconnected. Forty-eight exchanges are interconnected by trunk lines, and messages from one exchange to another are 'trunked' by special apparatus. Statistics obtained by the company show that on some days at least 75 per cent of the messages sent are 'trunked' from one exchange to another." President Fish, of the American Bell Telephone Company, followed Mr. Sherwin and talked for half an hour. He called attention to the fact that 14,000 of the 18,000 stockholders of the American Company are Massachusetts people, and he declared that the Bell Company is a Boston institution and recognized so the world over. The company is doing the best it can. It has made mistakes; it has suffered from inefficient development, but it is steadily improving and working with intelligent self-interest to give the people the best service possible. Every dollar raised by the Bell Company has been expended for construction, development and improvement. There has been no construction company and no water. Does the company earn too much? The New England is earning only 6 per cent, and surely that is not too much. He knew nothing of the men who were applying for franchises, and he did not know whether they had one dollar or a million, but he noticed that each was capitalized for only $5,000, "which shows that they don't care to take the people of Boston into their confidence."

DEVELOPMENT IN MISSISSIPPI.—Mr. H. C. Elder, secretary of the Gulfport and Mississippi Coast Traction Company, of Gulfport, Miss., writes us: "I beg to advise you that our line at present runs from Biloxi to Gulfport, a distance of about twelve miles; have also absorbed the local system in the city of Biloxi, formerly owned by the Biloxi Electric Railway & Power Company, as well as the electrical system of Gulfport Development Company, Gulfport, Miss. Our new plant is equipped with two 500 kw, 23-volt, 60-cycle, three-phase Westinghouse-Parsons turbo-generator outfits. We have now in operation, including local lines, about twenty-three or twenty-four miles of track. Our equipment consists of twelve interurban cars of the Brill semi-convertible type with four motor equipments. We have also some eight or ten smaller cars in local service. Our main power house will be in Gulfport and sub-stations at Biloxi and Pass Christian. Work on the line between Gulfport and Pass Christian has been started."

LARGE RAILWAY PLANT.—A notable sale of gas engine driven electric generating units has just been made to the Milwaukee Northern (Electric) Railway Company, whose plant will represent the largest installation of this kind on the continent. The power house of this company, which will be situated at Port Washington, Wis., is to contain three horizontal twin-tandem gas engines, each having a rated capacity of 1,500 hp, with liberal allowance for overload, direct-connected to three 1,000 kw, three-phase, 25-cycle alternating current generators. The complete units will be built and installed by Allis-Chalmers Company. The exciting units for these generators, which are to be driven by special vertical gas engines, will also be furnished by the Allis-Chalmers Company. All of the engines are to operate on producer gas.

THE AJAX LINE MATERIAL COMPANY has been organized in Chicago by Mr. Albert Scheible, a manufacturer of outdoor lighting specialties. The secretary and treasurer of the new company is Mr. John F. Turner. Mr. Albert Scheible, president of the company, graduated at the head of the original class of the Chicago Manual Training School. He took honors at Purdue, added another degree at Cornell and spent a year at Cleveland as assistant to the superintendent of the Swan Lamp Manufacturing Company. The last six years he has been associated with Mr. George Cutter. The Ajax Line Material Company has leased the entire floor of the building at 12-14 South Jefferson Street, Chicago, where the improved forms of outdoor lighting specialties designed by Mr. Scheible will be manufactured.

APPARATUS WANTED.—The bulletin of the Department of Commerce and Labor reports that J. R. Dobyns, superintendent of the Institution for the Deaf, Jackson, Miss., wants prices on ten motors from 1½ to 10 hp, 1,200 to 1,800 r.p.m. The Southern Aseptic Company, Columbia, S. C., wants motors. The C. C. and H. Mining & Milling Company, Webb City, Mo., wants a 100 32-candle power electric light dynamo and equipment. The Barclay-Bessonette Company, Temple, Tex., wants a combined exhaust fan and electric motor.

INDIAN TERRITORY POWER.—The Chickasha Water Power Company, Chickasha, I. T., has been incorporated with a capital of $75,000 to develop the water power of the Washita River, near that city. It is expected to put in a stone and concrete dam and install two 500-hp water wheels, two 375-kw, 6,000-volt generators, three miles of pole line and wires, and a number of three-phase induction motors. Mr. C. E. Ross is secretary and treasurer.

BARRIETT MOTOR EQUIPMENT.—The Barriett Electric Manufacturing Company, Cincinnati, recently equipped the entire plant of the Cincinnati Wire Bound & Box Company with its electric motors. These motors have given such perfect satisfaction that it has just received a duplicate order for the increased capacity required by the box company. Mr. C. H. Haddrell, president of the Barriett Company was an attendant at the recent Contractors' Convention at Cleveland.

ORDER FOR MINING PLANT.—The Traylor Engineering Company, 114 Liberty Street, New York, has received an order for hoisting, pumping and electrical machinery plant for the Sierra Consolidated Gold Mining Company, Hillsboro, N. M. The current for operating the machinery will be generated by two 125-kw generators, each direct-connected to 170-hp American Diesel oil engines. The other electrical equipment will include two 12½-kw generators, five 30-hp motors and one 15-hp motor.

SAN JOAQUIN POWER PLANT.—About fifty miles northeast of Fresno, on the north fork of the San Joaquin River in the Sierra Nevada Mountains, a new hydro-electric plant, owned by the San Joaquin Light & Power Company, of Fresno, Cal., was put in operation in April of this year. The actual work for construction of this plant, in which Allis-Chalmers generators are installed, was begun in May, 1905, but has been somewhat delayed by the fact that all material, except lumber, had to be transported into the mountains on freight teams. The conduit supplyng water has a total length of 4.3 miles and comprises open canal, tunnels, flumes and pipe line, designed for a flow of 100 cu. ft. per second, and, with the total head of 400 ft., giving a total capacity of 3,600 hp. The canal is 5 ft. wide on the bottom and 3 ft. deep. It is lined throughout with concrete. The intake basin and the forebay are concrete structures and the tunnels are also lined with concrete. The flumes are of steel plate ⅛-inch thick, semi-circular in form and 6 ft. wide. The pipe line is 3,000 ft. long and 52 inches in diameter; the thickness of steel varying from 3/16-inch to ½-inch. The water wheels are of the tangential type, two in number, and develop 83 per cent efficiency under full load. The two electric generators are of the standard Allis-Chalmers water-wheel type, 1,000 kw, 300 r.p.m., 550-volt, three-phase. Each machine is provided with a base and two bearings, the shaft at each bearing being extended to carry an overhung water wheel. The exciters are direct-connected, having armatures mounted on the generator shaft between the bearings. Each exciter is a 60 kw machine, and easily capable of furnishing exciting current for both alternators. The revolving field type of alternator is used with the rotor specially constructed for high peripheral speed, which in these machines reaches as high as 7,500 ft. per minute. The plant is the second one constructed by the San Joaquin Light & Power Company. The original plant is to be reconstructed and enlarged, and there are plans for other new plants to be built later.

CAHILL TELHARMONIUM PLANT.—One of the most interesting electrical developments in New York in many years is the construction of a plant of the Cahill "telharmonic" electrical system for the distribution of music on upper Broadway. The New York Electric Music Company has established itself at the big building occupied formerly by Park & Tilford, just north of the Casino Theatre, and has already laid out there what is certainly the most novel amusement centre the world has ever seen. A small part of the large area available has been retained for the company's offices, but all the remainder of the ground floor has been converted into a large auditorium of luxurious character. Here the keyboard is attached at which the performer plays; and here will be one or more telephone "horns" for delivering the music. The basement, or lower floor, which will probably also be a part of the show, contains the "dynamophone" itself, the unified bank of alternators generating the currents that furnish the music. Here also are the relay boards and the "tone mixers," exciter, etc., and a 200-hp motor on the Edison mains for running the plant. The apparatus has been installed under the direction of J. G. White & Company, of New York, whose Mr. Ellis has had the aid of some of the staff from the Cahill laboratory, at Holyoke, Mass. The wiring, etc., an elaborate piece of work, has been done very effectively by the Lord Electric Company. Mr. Oscar T. Crosby, the well-known engineer, who is largely interested in the enterprise, and Mr. F. C. Todd, of the General Electric Company's Baltimore office, have also watched the setting up of this two hundred tons of novel machinery, which is expected to go into operation this week. Meantime, a second dynamophone is under construction for the Pacific Coast, and a little later the New York plant will be equipped with a new keyboard rumored to be far in advance of the present one in the ability it lends to the performer.

POWER PLANT AT MINE.—An important development in connection with power production in Canada is being made by the Maritime Coal, Railway & Power Company, which owns extensive coal mining properties near Amherst, N. S. The company, whose president is Senator William Mitchell, is now turning out about 500 tons of coal per day. As in the case of other coal mines, there has accumulated at the pit's mouth vast quantities of screenings and other refuse. It is proposed to utilize these in the production of electric power, which will be sold to Amherst and the other towns and villages in the vicinity of the mine. The company has started work on their new power house and transmission line at the Chignecto mines. The power house is situated at the mouth of a coal mine. It is proposed to develop the power in large units and transmit it to Amherst and many other neighboring towns and cities by transmission lines. The company expects to be able to sell power at much lower rates than those now prevalent in that district. The prices in fact will be about the same as power sold from the great water power of Canada at Niagara or Shawinigan. Contracts for the machinery have been let. The Canadian Westinghouse Company, of Hamilton, will supply the generators, transformers, switchboards and all electrical apparatus. The Maritime Company expect to have its plant in operation before the first of January, 1907. Mr. David Mitchell, of Chignecto, is the general manager.

THE ELECTRO-DYNAMIC COMPANY'S sales of "Inter-Pole" motors continue to tax its facilities to the utmost. Among recent orders secured for variable speed motors, the following are reported: General Pneumatic Tool Company, 160 motors; United States Printing Company, 21 motors; National Elevator Company, 48 motors. Other sales in various quantities have been made to the Ball & Wood Company, of Elizabeth, N. J., Board of Water Supply of New York, Farrel Foundry & Machine Company of Ansonia, Conn., Solvay Process Company, of Syracuse, N. Y., and Gould & Eberhardt, of Newark, N. J. The demand for Inter-Pole motors was never greater than it is at present, and the company is making preparations to greatly enlarge its plant at Bayonne, N. J., extensively in order to provide for the increased business.

MAKING FURNITURE BY ELECTRICITY.—At the big office furniture factory of the Horrocks Desk Company, Herkimer, N. Y., the power house equipment contains three 450-hp boilers, supplying steam to a 250-hp engine, direct coupled to a 150-kw generator, and a smaller engine, 150-hp direct-connected to a 75-kw generator. The energy derived from this plant is applied to over seventy Allis-Chalmers induction motors, which drive every machine in the plant, either directly connected or belted to them from ceiling, side wall or floor. These motors range from 2 to 40 hp and aggregate over 500 hp in all. The main building is equipped with an extensive blower system operated by two 40-hp Allis-Chalmers induction motors; shavings are carried directly to the power house and automatically fed to the boiler furnaces.

THE PLATT IRON WORKS COMPANY, which has long had offices on Liberty Street, in New York City, has been forced by the growth of its business to take larger office quarters at 100 Broadway. A large wareroom with a complete line of all patterns of pumps and compressors, feed-water heaters, condensing apparatus, etc., has also been established at 81 West Street, where repairs are carried in stock for prompt shipment. The New York office of this company is in charge of Mr. R. E. Fox, Jr., who for a considerable time managed the Atlanta (Ga.) office of the Stilwell-Bierce and Smith-Vaile Company, before that company's business was acquired by the Platt Iron Works Company.

SALE OF COMMERCIAL ELECTRIC.—The plant of the Commercial Electric Company, Indianapolis, has been sold to the Fairbanks-Morse Electric Manufacturing Company. The new company took over the Indianapolis plant. It was incorporated recently as an Indiana company, with a capital stock of $150,000. The new company, while not owned by the Fairbanks-Morse Company, manufacturers of scales and machinery, will be allied with and controlled by that company. The new owners say they intend enlarging the Indianapolis plant to double its present capacity.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was irregular, with a rather strong undertone, having had during the week a general advance on renewed bullish manipulation by large interests, with considerable short covering. Active interest centered in a comparatively limited number of stocks, which were handled in a way to influence prices generally. The Steel stocks were the strongest features, and there seemed to be an aggressive demonstration against the shorts in the common, the market on Friday being influenced by reports that an element in the Steel directorate favored the resumption of dividends on the common stock. Amalgamated Copper was not especially prominent, but shared in the general improvement, while Brooklyn Rapid Transit was irregular, there being conflicting rumors about the action of the State Railroad Commissioners in relation to this property. There was greater strength in the electric and traction securities, all of which closed with substantial gains to their credit. Allis-Chalmers common closed at 17⅞ and preferred at 49¼, these quotations being advances of 1 3/7 and 4¼, respectively. General Electric closed at the highest figure of the week, 167¾, this being an advance of 4¾ points, and Westinghouse closed at 153. Brooklyn Rapid Transit ranged between 73⅝ and 77¾,

closing at 77½, which price is a net advance of 2¾ points on the week's business. Inter-Metropolitan common closed at 38½ and preferred at 78, these being net gains of ¾ and 1¼ points, respectively. American Locomotive common made a gain of 2½ points, closing at 72¼, while preferred lost ½, the last quotation being 114. Western Union advanced ⅜, closing at 92⅜, and New York & New Jersey Telephone closed at 130. American Telephone & Telegraph Company closed at 130¼, after having reached 144⅝. On the curb market there was no special feature except for a curtailment of operations compared with what they were before the stock transfer tax was construed by the Attorney-General as compelling the payment of a rate of two cents for each share, irrespective of the par value. Mackay common closed at 74½, which is an advance of 2½ points and preferred at 72½, a gain of ¾. Following are the closing quotations of July 31:

NEW YORK

	July 24	July 31		July 24	July 31
Allis-Chalmers Co.	16⅝	17⅛	General Electric	164	166⅝
Allis.Chalmers Co. pfd.	47	48	Hudson River Tel.	...	...
American Dist. Tel.	25	25	Interborough Rap. Tran.	...	...
American Locomotive	69¼	72¼	Mackay Cos.	71¼	74⅛
American Locomotive pfd.	113	113	Mackay Cos pfd.	72¼	72⅜
American Tel. & Cable	90	90	Marconi Tel.	...	...
American Tel. & Tel.	128	125	Metropolitan St. Ry.	...	...
Brooklyn Rapid Transit	74⅛	78	N. Y. & N. J. Tel.	...	...
Electric Boat	25	18	Western Union Tel.	91⅜	91⅜
Electric Boat pfd	70	55	Westinghouse com.	152	150
Electric Vehicle	10	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	12	*40			

BOSTON

	July 24	July 31		July 24	July 31
American Tel. & Tel.	131	133½	Mass. Elec. Ry. pfd	68	69
Cumberland Telephone	115¼	115⅛	Mexican Telephone	4	...
Edison Elec. Illum.	...	237	New England Telephone	131	131
General Electric	165¼	166	Western Tel. & Tel.	...	11
Mass. Elec. Ry.	...	20⅛	Western Tel. & Tel. pfd.	...	88

PHILADELPHIA

	July 24	July 31		July 24	July 31
American Railways	52¼	52⅛	Phila. Electric	8	8
Elec. Co. of America	11	11⅛	Phila. Rapid Trans.	30	30⅛
Elec. Storage Battery	68	72	Phila. Traction	99	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	July 24	July 31		July 24	July 31
Chicago City Ry.	160	160	National Carbon	84	84
Chicago Edison	...	136	National Carbon pfd.	119	121
Chicago Subway	44	46	Union Traction	...	...
Chicago Tel. Co.	...	121	Union Traction pfd	...	...
Metropolitan Elev. com.	27	27			

* Asked

WESTINGHOUSE ELECTRIC.—At the annual meeting last week, which was of a rather contentious character on account of discussions raised by minority stockholders, the first full statement of earnings, for some years, was made by the Westinghouse Electric & Manufacturing Company. The income account for the six years ended March 31, 1906, is as follows:

Gross	$114,618,537
Cost of shipments	97,726,008
Net	16,892,529
Other income	3,664,590
Total net	20,557,119
Deductions	7,079,653
Net income surplus	13,477,466
Other P. and S. surplus	7,985,246
Gross surplus	21,462,712
Dividends paid	9,922,069
Surplus	11,540,643

The Westinghouse Company issues the following statement as of March 31, 1906, which is compared below with the statements of condition November 30, 1905, and June 30, 1904:

	Mar. 31, '06.	Nov. 30, '05.	June 30, '04.
ASSETS.			
Property and plant	$11,078,355	$10,938,764	$10,047,615
Quick assets	28,361,913	22,336,214	18,739,349
Investments	22,587,190	21,696,214	15,134,501
Other assets	7,034,537	6,951,029	5,457,012
Total	$69,061,995	$61,922,221	$49,378,477
LIABILITIES.			
Capital stock	$24,998,700	$24,998,700	$22,493,050
Funded debt	17,500,000	15,000,000	.....
Collateral notes	6,000,000	6,000,000	2,000,000
Current liabilities	9,022,653	3,857,848	13,223,678
Profit and loss surplus	11,540,642	12,065,673	11,661,749
Total	$69,061,995	$61,922,221	$49,378,477

ATTRACTIVE ELECTRICAL SECURITIES.—The bonds of trolley, electric light and power companies have been particularly prominent in the New York market since the beginning of the present year, remarks the *Wall Street Journal*. Bond houses like to take up issues of this class, since experience has taught them that ready sales can be made to that class of investors who look with favor upon a bond which possesses speculative possibilities and offers a fairly high yield. The majority of trolley and electric light bonds bear 5 per cent interest or better, and are very frequently offered on better than a 5.50 basis. They come out in small blocks and can be much more readily handled in a market like the present one than almost any other kind of bond. Of course, those who buy such bonds generally rely solely on the judgment of their brokers, who have the means of obtaining the necessary information concerning those properties which are little known to the investing public. The largest issue of these bonds recently offered in the New York market is the $67,406,000 collateral trust 4½s of the Interborough-Metropolitan Street Railroad. Besides this issue, nine other offerings of $1,000,000 or more each aggregated $24,196,000. A list of these larger issues follows: Tri-City Railway & Light 5s, $6,000,000; Birmingham Railway Light & Power 4½s, $5,000,000; Union Electric Light & Power (St. Louis) 5s, $3,000,000; Trenton, Lakewood & Atlantic 5s, $2,500,000; Central Crosstown 5 per cent notes, $2,250,000; Lehigh Valley Transit 5s, $1,830,000; Edison Electric (Los Angeles) 5s, $1,500,000; Old Colony Street Railway, reference, 4s, $1,116,000; Detroit United 5 per cent notes, $1,000,000. In addition to these the New York houses have offered bonds of smaller corporations in blocks of from $100,000 to $900,000, to a total of about $5,000,000.

BOSTON EDISON FINANCES.—It is reported from Boston that stockholders of the Edison Company, of Boston, will be given the privilege this fall of subscribing for new stock. It is expected that the increase will be at least 10 per cent. The last issue was made in 1904 when the capital was increased 10 per cent, the new shares being offered at $200 a share. The company is carrying a large floating debt, the result of large purchases of real estate in the past year, and this debt will be increased upon the completion of the new building on Boylston Street for the exhibition and operating departments. At present a large portion of the operating force is at the Atlantic Avenue plant. In the past four years the company has increased its capital from $7,850,000 to $11,488,100. The company values its plant and system at $29,000,000. The capital stock is supplemented by $2,486,000 mortgage bonds.

DIVIDENDS.—The directors of the National Carbon Company have declared the regular quarterly dividend of 1¾ per cent on the preferred, payable August 15. A regular semi-annual dividend of 2½ per cent on the preferred stock of the Philadelphia Company has been declared, payable September 1, as registered August 10. The Ohio Traction Company has declared a quarterly dividend of 1¼ per cent on its $8,500,000 preferred stock outstanding, payable August 1. The Missouri & Kansas Telephone Company has declared a regular quarterly dividend of 1½ per cent. The American Graphophone Company has declared the regular quarterly dividend of 1¾ per cent, payable August 15. The West Penn. Railways Company has declared its third quarterly dividend of 1¼ per cent on the preferred stock, payable August 1.

CONTRACTORS ASSIGN.—The Gustave S. Neu Company, electrical contractors, at No. 125 Grand Street, New York City, has made an assignment to William H. Roberts. The business was started in 1888 by Gustave S. Neu, who incorporated it on March 28, 1904, with a capital stock of $10,000 and became the president. He has been ill for a long time and last spring new people became interested in the business, and Mahlon S. Graver succeeded Mr. Neu as president. In December last the company obtained an extension of six, nine and twelve months, when the liabilities were reported to be about $4,000. The company manufactured a motor table for sewing machines and a float for water tanks.

INTERNATIONAL STEAM PUMP.—The stock of International Steam Pump has been strong during the past week. This is attributed to the final consummation of the plan whereby the Steam Pump Company acquires the Power & Mining Machinery Company and the Guggenheim property. Stockholders of the Steam Pump Company voted favorably last May on the proposition to issue 25,000 shares of preferred stock and 55,000 shares of common stock to be taken by the Power & Mining Company in payment for its capital stock.

MUNICIPAL BONDS ILLEGAL.—The Edison Electric Light Company, of Los Angeles, Cal., has brought suit against the city of Pasadena to enjoin $2,000,000 issue of electric light plant bonds which were voted on May 3 for the establishment of a municipal lighting plant. The Edison Company, which supplies electricity to the territory, claims that the election was illegal.

NASHVILLE BONDS.—The Nashville Railway, Light & Power Company has just decided to issue $10,000,000 of 5 per cent bonds, of which $6,000,000 will be issued to retire old securities and $1,500,000 in improvement and enlargements of the car lines.

GENERAL NEWS.

Construction News.

HORSE CREEK, ALA.—The Pratt Consolidated Coal Company is preparing to build an electric light plant to furnish light for the city of Horse Creek.

MONTGOMERY, ALA.—P. R. Whiting, Secretary Citizens' Light & Power Company, writes that contracts for additional equipment have been awarded to the Westinghouse Electric Manufacturing Company and the Harrisburg Foundry & Machine Company, to cost about $25,000.

MALVERN, ARK.—The electric lighting plant in this place, owned by B. W. Turner, was destroyed by fire on July 21, entailing a loss of about $5,000.

OAKLAND, CAL.—The entire plant of the Standard Underground Cable Company, located at First and Linden Streets, this city, was destroyed by fire on July 20, entailing a loss of $100,000.

REDLANDS, CAL.—Work has commenced on the construction of the new electric plant of the Redlands Home Gas & Electric Company. A duplicate system will be installed of 500 hp capacity. It is expected to have the plant completed and in operation by Nov. 15. The Traction Engineering Company has the contract for the entire work.

FRESNO, CAL.—Preparations are being made by the San Joaquin Power Company for the construction of two power plants on the Tule River. Permanent surveys are now in progress and will be completed by August 1. The first plant will have a capacity of 6,000 hp and the second 4,000 hp. The Tule River plants will be made part of the same system as the North Fork plants. With the four plants on the San Joaquin and the two on the Tule River the capacity will be between 30,000 and 35,000 hp.

SAN DIEGO, CAL.—The National City & Otlay (steam) Railroad has been formally transferred to the John D. Spreckels interests. The officers are as follows: John D. Spreckels, president; William Clayton, vice-president and managing director; Harry L. Titus, secretary and treasurer; B. M. Warner, general superintendent. The road extends from San Diego to Tia Juana on the Mexican border, and the work of electrifying the line as far as Chula Vista, which has already been commenced, will be pushed forward. The construction of three new cars for the line will be started. Electricity for the line will be supplied by the power house of the San Diego Electric Railway.

MANITOU, COL.—Work will commence at once on the construction of the large power plant to be erected by the Empire Water & Power Company in this city.

ROCKVILLE, CONN.—It is expected that the transmission line between Hartford and Rockville will be completed about the middle of August, when the Hartford Electric Light Company will furnish electricity for lighting the streets of Rockville and Stafford Springs. The plant of the Rockville Gas & Electric Company will be held in reserve in case of emergency.

WILMINGTON, DEL.—The directors of the Street and Sewer Department have granted a franchise to the Commercial Light & Power Company to furnish gas and electricity in the city. The company in return offers to pay the city $50,000 within a year, to furnish gas to the public at 90 cents a thousand, 10 cents less than the present price; to furnish gas to the city at 73 cents a thousand, also to install 500 or more arc lamps at $40 per lamp per year (the city is now paying $64), and to pay the city 3 per cent annually of the receipts from the lighting business. The company will expend $100,000 within one year in constructing its plant.

WASHINGTON, D. C.—Bids will be received until August 14 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 66—Thermostats, conduit and fittings, lava insulators, contacts and blades, insulated wire, electrical supplies, refitting storage battery tanks, etc. Schedule 68—Sheet copper, steel forgings and castings, etc. Schedule 70—Gasoline marine motor, valve reseating machine, pipe cutters, tube expanders, etc. Also until Aug. 21 to furnish at the Navy Yards at Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 62—Pulleys, hydraulic jacks, drills, etc. Schedule 63—Motors, electrical supplies, hydraulic packs, bilge pumps, bar steel, etc. Application for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

WINTER GARDEN, FLA.—It is reported that an electric light plant will soon be established in this place. W. Percy Reams is interested.

TAMPA, FLA.—The Tampa Electric Company is making preparations for the construction of a large power house on the Hillsborough River, which will furnish electricity for the new extension of its system.

CHICAGO, ILL.—Plans are being prepared for the construction of a large power plant for the Latrobe branch of the Railway Steel Springs Company, which will cost $500,000. Work will soon commence on the construction of the building.

LA SALLE, ILL.—The City Council has authorized the Mayor to appoint a committee of three to make arrangements with the telephone, telegraph and traction companies for putting their wires under ground in the business section of the city.

CHICAGO, ILL.—Bids will be received until August 17 by William L. O'Connell, Commissioner Public Works, for furnishing and erecting in the 14th Street pumping station a direct connected automatic cut-off engine and a 35-kw direct-current generator.

EDWARDSVILLE, ILL.—It is announced that $100,000 will be spent for improvements to the McKinley syndicate's power house in Edwardsville. The plant will be largely increased to make it an auxiliary substation for the running of the interurban lines. The company applied for a franchise to construct another city line in Edwardsville from the city square north along Second Street to the city limits, and it was granted. Work will begin shortly.

CARTHAGE, IND.—The Council has granted a franchise to J. W. Beck for an electric light plant.

RICHMOND, IND.—Work on the extension and improvement of the municipal electric lighting and power plant will begin November 1.

PORTLAND, IND.—The City Council and the Commissioners of Jay County have granted additional franchises to the Muncie & Portland Traction Company for an extension of the line from Portland to Celina, Ohio.

MARION, IND.—The Marion, Bluffton & Eastern Traction Company has contracted with the Marion Light & Heating Company for electricity for the immediate operation of its new line completed from Marion and Van Buren.

GOSHEN, IND.—The Northern Indiana Railway Company has decided to rebuild its power house at Osceola, which was recently wrecked by a wind storm. Plans are made for a more substantial building, and this work will be completed before the Goshen extension is built.

LOGANSPORT, IND.—The contract to build the extension of the Wabash Valley Traction Company's line from this city to Lafayette, a distance of 42 miles, has been let in five sections. The contractors are working at their best to complete the work by December 1.

INDIANAPOLIS, IND.—The Indiana Rapid Transit Company, P. M. Dunn, president, is reported to have announced that the bonds have been sold assuring the building of a line from Logansport to Terre Haute, and that bids for the construction of the road would be invited soon.

HAMMOND, IND.—Construction work has begun on a branch of the Chicago, Lake Shore & South Bend Electric Road, between this city and Kensington. Work will also begin Aug. 1 on the branch between this city and Indiana Harbor to connect with a line which the company is now operating to East Chicago.

FRANKLIN, IND.—The Franklin Water, Light & Power Company has been purchased by the Ferris Brothers, owners of lighting and water plants at Yankton, S. D., and Eldorado and Osage, Ia. Thomas Ferris, now managing the Osage plant, will come to Franklin to take charge of the plant. The plant will be improved and new machinery installed.

INDIANAPOLIS, IND.—The Marion County Superior Court has granted Charles L. Henry, receiver of the Indianapolis & Cincinnati Traction Company, the authority to issue $900,000 worth of receiver's certificates to pay for the completion of the construction and for the equipment of the Connersville and the Greensburg extensions of the road.

RED OAK, IA.—The electric light plant of the Red Oak Electric Company has been purchased by A. C. Rhine, of Lancaster, Mo.

MARSHALLTOWN, IA.—Hamilton Browne, who has the contract for the construction of an electric railway from Marshalltown to Ferguson, has secured an option on the property of the Marshalltown Electric Light & Gas Company, which operates the street railway system of Marshalltown. Mr. Browne expects to run the street railway system in connection with the interurban line. He states that he will construct an extension to Conrad, Ia., immediately after constructing the line to Ferguson, and that he also expects to extend several city lines as soon as he secures control of the city railway system.

NOWATA, KAN.—John Heck and J. P. Rossiter, of Coffeyville, Kan., have applied to the Council for an electric light franchise in Nowata.

HOWARD, KAN.—The telephone system in this city and in Savery and the toll line between the two towns, owned by Dr. J. H. Close, have been purchased by the O. B. Walker Telephone Company.

LEAVENWORTH, KAN.—The independent telephone plant in this city, owned by Feder, Selberg & Co., of Cincinnati, Ohio, has been purchased by A. E. Conklin, L. R. Parker and William George, of Aurora, Ill.

GARDEN CITY, KAN.—Kenion & Hubbell, of Chicago, Ill., have secured the contract for furnishing complete, ten motor-driven centrifugal pumps of 52 second-feet capacity, to be used in the Garden City irrigation project for $13,750.

LOUISVILLE, KY.—A permit has been granted to the Louisville Lighting Company for the erection of a three-story building, on Third Avenue, which will be used as a sub-station. The estimated cost is $14,000.

LOUISVILLE, KY.—The Louisville, New Albany, French Lick & West Baden Railway Company, which proposes to construct an electric railway from New Albany to French Lick and West Baden Springs, has applied to the New Albany Board of Public Works for a right of way over a number of the streets of that city.

ARCADIA, LA.—The citizens are considering the question of establishing a municipal electric lighting plant.

HALLOWELL, ME.—The Kennebec Light & Heat Company has completed its sub-station in this town and is now supplying electricity through the transformer station. The company has replaced the old arc lighting system by new and improved arc lamps.

CALAIS, ME.—The Calais Street Railway Company has secured control of the water privilege at Salmon Falls, owned by the Washington County Railway, and will erect a large power station at an early date to furnish electric power for commercial purposes.

PORTLAND, ME.—The Portland Electric Light Company has bought the Hargreaves Woolen Mill property at West Buxton, and will soon commence the construction of a power station for the transmission of electricity for lighting and power purposes in Portland and vicinity.

TURNER FALLS, MASS.—At a recent town meeting the citizens voted to contract with the Franklin Electric Company to furnish 36 arc lamps at $87.50 per lamp per year.

PITTSFIELD, MASS.—The Pittsfield Electric Company is installing a 6,000-gallon oil tank at its new plant at Silver Lake. It is the intention of the company to operate the new plant by oil engines.

LEOMINSTER, MASS.—At a meeting of the stockholders of the Leominster Gas Light Company held July 25, it was voted to merge with the Boston Heat, Light & Power Company. The latter company already controls several lighting companies in this vicinity.

WORCESTER, MASS.—Plans have been prepared by Thompson & Gallagher for an electric lighting and power plant for Denholm & McKay Company. Four electric generators, four Ames engines and a 420-hp Stuart boiler will be installed. Plans for the power house are being prepared by Frost, Briggs & Chamberlain.

ORANGE, MASS.—The Orange Electric Light Company is planning extensive improvements to its plant, and expects to have its day circuit for power ready about October 1. Several local companies are making arrangements to use electric power to operate their plants as soon as the company is ready to supply the electricity.

AMHERST, MASS.—Arrangements have been made by which the Amherst Gas Company is to receive electricity to supply the demands of Amherst, Sunderland, Hatfield and Pelham, from the plant of the Turners Falls Company located at Turners Falls. A transmission line will be constructed from Turners Falls, a distance of 18 miles. The plant at Turners Falls has a capacity of 7,000 hp, and the company owns rights at another location on the stream where 10,000 hp additional can be developed.

SPRINGFIELD, MASS.—The Hartford & Springfield Street Railway Company, at its annual meeting July 17, voted to increase its capital stock by issuing 850 shares of 6 per cent preferred redeemable at 110. W. A. Tucker, of Boston, was elected president, and Chauncey Elbridge, of Boston, treasurer. Judge Robinson, in the Hartford County Superior Court, has authorized the Stafford Springs (Conn.) Railway Company to transfer to the Hartford & Springfield certain rights under its charter whereby the latter company may build a 4-mile extension from Stafford to Somerville, Conn.

TEMPLETON, MASS.—At a special town meeting held July 25 the citizens voted to appropriate the sum of $6,500 in addition to the $15,000 previously appropriated for the construction of a plant for the distribution of electricity in the town of Templeton. The sum of $750 was also appropriated to pay for the electricity and to maintain the plant until March 1, 1907. Work will commence at once on installing the plant; the town will be wired for street and commercial lights; electricity will be obtained from the Gardiner Electric Light Company, at the rate of four cents per kw-hour delivered at the Gardiner town line.

BOSTON, MASS.—A syndicate representing financial and manufacturing interests in Massachusetts will soon petition the Railroad Commissioners for the right to construct an electric interurban railroad between Beverly and Boston, passing through Salem, Peabody, Lynn, Saugus, Revere and Chelsea. From Peabody a line will be extended to Danvers via Danvers Port. The road will be known as the Boston & Eastern Electric Railroad, and is planned to be of the high-speed class, wholly upon private right of way, and will have no grade crossings whatever. The articles of association contain the names of John H. Bickford, Salem; Arthur Sturgis, Brookline; Harry P. Graves, Lowell; William H. Grove, Salem; George C. Vaughn, Salem; Melville Woodbury, Beverly; William S. Nichols, Salem; Fred A. Norton, Salem; William E. Bixby, Haverhill; John H. Lincham, Beverly; E. Bertram Newton, Boston.

MARQUETTE, MICH.—The Michigan Telephone Company is to install the central energy system in this city, and will spend about $50,000 for new equipment.

GRAND RAPIDS, MICH.—Edward M. Deane & Co., of this city, together with the Boston banking house of E. W. Gay & Co., have purchased the Tacoma Gas & Electric Light Company, of Tacoma, Washington. The price paid for the property will make an investment of close to $1,500,000.

BERRIEN SPRINGS, MICH.—The Berrien Springs Power & Electric Company, of which Charles A. Chapin is president, will make application to the Board of Supervisors of Berrien County for permission to construct a dam across the St. Joseph River at the head of Pardee Island in the Village of Berrien Springs.

YPSILANTI, MICH.—The power house of the Detroit, Ypsilanti, Ann Arbor & Jackson Electric Railway at Ypsilanti was struck by lightning July 22, causing a loss of about $5,000. One transformer was destroyed and the roof of the building burned. Besides the repairs which are now necessary, the company will make a number of additions, the machinery having been ordered.

TECUMSEH, MICH.—The Tecumseh Electric Company is installing a new 150-kw alternator as an addition to the present plant, and is equipping the Uncle Sam Macaroni Company with electric power. It has also contracted to supply power for 75 to 125 hp of motors to the Anthony Fence Company, and is supplying power to the Tecumseh Stove & Furnace Company. A day service was started in January, 1906. L. B. Schneider is president.

MONROE, MICH.—The major portion of the stock of the Monroe Gas & Electric Light Company has been purchased by Detroit and Ann Arbor capitalists. The following-named officers and directors were elected: H. A. Conant, of Monroe, president; J. W. Thompson, of Detroit, vice president; J. C. Sterling, of Monroe, secretary; W. E. Morse, of Detroit, treasurer. Directors: H. A. Conant, Boyez Dansard and J. C. Sterling, of Monroe; B. O. Tippy, H. E. Bondman, W. E. Moss and J. W. Thompson, of Detroit.

LANSING, MICH.—The Michigan United Railways Company has filed a document deeding in trust for $7,500,000 to the Knickerbocker Trust Co., of New York, all of its property, franchises, assets, etc., now owned or hereafter acquired. This action, it is understood, is for the purpose of covering an issue of first mortgage gold bonds for $7,500,000. It is understood that this loan was negotiated for the purpose of taking up other issues of bonds, the building of the proposed Lansing-Jackson road and the making of extensive improvements on all of the lines.

HIBBINGS, MINN.—A new dynamo, engine and boilers will soon be purchased for the municipal electric light and water plant.

RED LAKE FALLS, MINN.—It is reported that Edward Nealy is contemplating the construction of a power house in this place.

UNION STAR, MO.—A stock company has been organized in this city for the purpose of installing an electric light plant. The engine has been installed, and everything is in readiness but the purchase of the dynamo and the wiring of the town.

CLAYTON, MO.—It is announced that work on the St. Louis, Webster & Valley Park Railroad will shortly be resumed, the money for the work having been raised in a $1,500,000 bond issue. The Trust Company, of St. Louis County, is trustee for the bond-holders. The road will be double-tracked from West End Heights to Valley Park.

SPRINGFIELD, MO.—The Springfield Gas & Electric Company is contemplating extensive improvements to its system. It is the intention of the traction company to purchase at least six new cars, and the installation of some new boilers of larger capacity than the ones now in use at the power house is also contemplated. W. A. Bixby is superintendent.

ST. LOUIS, MO.—The St. Louis, Hillsboro & Southern Railway will be built within the next eight or ten months, according to H. M. Bowen, vice-president and general manager. The contract to build the road was let July 10, and grading will begin during the next sixty days. The road will be approximately 40 miles in length, and engineers estimate its cost at $648,700. This includes grading, terminals, equipment, power plant, etc. The system will be an electric one. The company includes in its right of way Bobring, Sappington, Luxemburg, Crane's Nest, Fenton, High Ridge, Houser Springs, Local, Byrnesville, Cedar Hill, Regina and Hillsboro. Water power will be utilized by the company. Its power house will be in Jefferson County. Following are the officers and directors of the company: President, R. E. Williams; vice-president and general manager, H. M. Bowen, of Alton; secretary, H. D. Brandt; treasurer; J. H. Winer, of Hillsboro, and S. D. Winter.

TECUMSEH, NEB.—The Johnson County Home Telephone Company has purchased the local exchange and rural lines of the Adams Telephone Company. The new acquisition gives the telephone company a total of about 1,000 telephones.

ELIZABETH, N. J.—John F. Kenah, city clerk, writes that bids will be received on August 1 for lighting the streets of the city. Bids will be received for 1, 2, 3, 4 and 5 years. The present contract expires on September 1.

TRENTON, N. J.—At a recent meeting of the directors of the Trenton, Hamilton & Ewing Traction Company, a subsidiary of the Trenton Street Railway Company, it was determined to build the line to Hamilton Square this year, and not wait until next spring, as had previously been decided.

UTICA, N. Y.—The Hudson River Electric Power Company has applied to the City Council for a franchise to distribute heat, light and power in the city of Utica.

WATERFORD, N. Y.—A. J. Weaver, village president, has awarded the contract for street lighting to the Waterford Heat, Light & Power Company for a period of five years at $94.90 per lamp per year.

ROCHESTER, N. Y.—Bids will be received until Aug. 23 by the Board of Contract and Supply for lighting the streets of the city for a period of 1, 2 and 5 years, beginning July 1, 1907. Frank X. Pifer is clerk.

POUGHKEEPSIE, N. Y.—The State Commission on Gas and Electricity is considering the application of the Poughkeepsie Light, Heat & Power Company for permission to issue $150,000 bonds for extending its plant.

NEW YORK, N. Y.—Bids will be received until August 6 by C. B. J. Snyder, Superintendent School Buildings, New York City, for installing electrical equipment in the addition to School 28, Borough of Bronx.

NEW YORK, N. Y.—The New York, Auburn & Lansing Railroad Company, which is to construct an electric road from Auburn to Ithaca, has authorized a bond issue of $1,000,000 thirty-year, 5 per cent bonds. Engineers estimate the surplus earnings of the company at $96,000 annually. It has a contract for power with the Niagara, Lockport & Ontario Power Company.

DANSVILLE, N. Y.—The Dansville Gas & Electric Light Company has sold its plant to A. B. Beadle, of New York, N. Y.; M. A. Maxwell, of Easton, Pa., and W. W. Levering, of Philadelphia, Pa. It is reported that about $20,000 is to be spent in improvements which will include the installation of new engines, dynamos and new street arc lamps. Harry Clark is to be manager of the new company.

SYRACUSE, N. Y.—A certificate has been filed with the Secretary of State certifying to the merger of the St. Lawrence Telephone Company, the Central New York Telephone & Telegraph Company, the Oneonta Telephone Company, the Milford Telephone Company and the Madrid Telephone Company under the title of the Central New York Telephone & Telegraph Company. Hiram F. Stevens, of Syracuse, is vice-president.

COLLIERS, N. Y.—The Stevens-Hewitt Engineering Company, of New York, has been retained as engineers for the development of a large water power on the Susquehanna River at Colliers, N. Y. The concrete-steel dam, 35 ft. high and 300 ft. long, together with the concrete-steel canal wall, about 600 ft. long, are designed and built under supervision of the Ambursen Hydraulic Construction Company, of Boston. Work has already been commenced in stripping the foundations.

CHARLOTTE, N. C.—The new machinery for the power plant of the Charlotte Street Railway will be installed early in the fall. The company will replace the steam engines now in use by gas engines.

ROANOKE RAPIDS, N. C.—The Roanoke Rapids Power Company contemplates an expenditure of about $100,000 in improvements to its system. M. C. Cooper is general manager. Joseph H. Wallace, Temple Court Building, New York City, is the engineer in charge of the work.

ENDERLIN, N. D.—It is reported that an electric light system will be established in this place.

LAKE IDLEWILD, OHIO.—The lighting plant in this place was destroyed by fire, entailing a loss of $1,500.

ZANESVILLE, OHIO.—The Central Union Telephone Company will make extensive improvements in its system in this city at a cost of $75,000.

CHARDON, OHIO.—The Village Council has voted an appropriation of $3,500 for the purpose of improving and enlarging the municipal lighting plant.

AKRON, OHIO.—The Northern Ohio Traction & Light Company contemplates making extensive improvements on its main line between Akron and Cuyahoga Falls.

MARION, OHIO.—The Columbus, Delaware & Marion Railway Company has secured a 25-year franchise. The company will extend its local system and secure an outlet for its line to Bucyrus.

WARREN, OHIO.—The lighting franchise of the Warren Water & Lighting Company is soon to expire and citizens are agitating the question of having the city buy the water works and lighting plant.

HAMILTON, OHIO.—The Board of Public Service is experimenting with several new forms of enclosed arc lamps and it will shortly place contracts for lamps of this type to illuminate the entire city.

BARBERTON, OHIO.—East Liverpool interests have leased the Barberton pottery plant and will make preparations commencing August 1 to go into the manufacture of insulators and other electrical supplies.

WOOSTER, OHIO.—Citizens of Wooster have asked the Cleveland & Southwestern Traction Company to build a local line in that place to the Government experimental stations and several other stations south of the city.

LIMA, OHIO.—The City of Lima is installing in its municipal water works pumping station a 300-hp engine and a 200-kw generator, to supply electricity for operating several motor driven pumps at distant points in the city.

MASSILLON, OHIO.—The Central Union Telephone Company is planning to reconstruct its system here, installing additions to the switchboards, placing open air wires in cables, of which about 12 miles will be erected.

BELLEFONTAINE, OHIO.—The Bellefontaine municipal lighting plant has recently been enlarged and the city is now securing a day commercial load. The Bellefontaine Foundry & Machine Company is planning to install an 80-hp motor.

NEWARK, OHIO.—The Indiana, Columbus & Eastern Traction Company is making plans to increase greatly the capacity of the Hebron power station of the Columbus, Buckeye Lake & Newark Division. Four 300-hp boilers and a large generator will be installed.

AKRON, OHIO.—Thomas L. Childs, an Akron promoter, is securing right of way for a line from Ravenna to Leavittsburg by way of Garrettsville. This will connect the system of the Northern Ohio Traction Company with that of the Mahoning Valley Traction Company.

CINCINNATI, OHIO.—The Schoepf syndicate has placed contracts for the extension of the Indianapolis & Western Traction Company's line from Greencastle to Brazil. The road is about completed as far as Danville, and the Greencastle extension will probably be completed this year.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company has awarded the contract for the construction of the new exchange building in Collinsville to Samuel Austin & Son Company. The company is making extensive improvements to its system in that place at a cost of $50,000.

TORONTO, OHIO.—The village of New Cumberland has granted a franchise to Van Horn Ely for furnishing light, heat and power in that town. Electricity will be supplied from the plant of the Toronto Light, Heat & Power Company of this place, which is owned by the Ely syndicate.

CANTON, OHIO.—The reorganization of the Merchants' Heat, Light & Power Company, which company recently passed into the control of Cleveland people, has been effected and the following named officers elected: C. R. Morely, president; Thomas F. Turner, first vice-president; David Morrison, second vice-president; Edward Wiedenson, treasurer; T. B. Steiner, secretary and assistant treasurer.

PORTSMOUTH, OHIO.—President Comstock, of the Cincinnati, Georgetown & Portsmouth Railway Company, with a force of engineers, is securing right of way, a layout and routes for an extension of the line from West Union to Portsmouth, a distance of 35 miles. The line will touch a number of villages which at present have no railway facilities of any kind. The line into West Union will be completed this year.

CLEVELAND, OHIO.—The Cleveland, Painesville & Eastern Railway Company expects in the near future to close contracts for six 52-foot cars for the limited service between Cleveland and Ashtabula. Contracts will also be closed for 65-hp motors, which will be placed under the six cars recently acquired from the Cleveland, Painesville & Ashtabula Railway. It is reported that the company will soon abandon the old power station at Willoughby and utilize the Cleveland, Painesville & Ashtabula station at Painesville for operating the entire road.

DAYTON, OHIO.—The City Council has adopted a resolution instructing the city engineer to report on the feasibility of utilizing the old Dayton View hydraulic and storm sewer for water power for operating a municipal electric light plant. A resolution was also adopted to place before the public at the November election a proposition for issuing $500,000 bonds for the erection of a municipal gas and electric plant. An ordinance has been introduced in the City Council calling for the enlargement of the conduit system and requiring telephone, telegraph and electric lighting companies to place their wires underground in the business section of the city.

EUGENE, ORE.—The City Council has passed an ordinance granting to the Willamette Valley Traction Company a franchise for a suburban and city street car system.

SALEM, ORE.—The Salem City Council has granted the Willamette Valley Traction Company a franchise to build and operate a line through the city. The Willamette Valley Traction Company announces a road from Portland to Hillsboro and Forest Grove, construction of which will begin within a short time.

BEAVER, PA.—The Peoples' Telephone Company is planning to make extensive improvements to its system in this city.

AMBLER, PA.—The Bell Telephone Company is making extensive improvements to its system in this city, which will cost more than $50,000.

KUTZTOWN, PA.—The citizens have voted in favor of issuing $10,000 for the improvement and enlargement of the municipal electric light plant.

NORRISTOWN, PA.—Plans are being prepared by the Bell Telephone Company for the erection of a new exchange building in this city at a cost of about $40,000. John T. Windrim is the architect.

EIDENAU, PA.—The Pittsburg, Harmony, Butler & New Castle Street Railway Company is asking for bids for the construction of the power house for the proposed line, which will be located in this city.

PITTSBURG, PA.—At a recent meeting of the Council a resolution was adopted directing the city solicitor to prepare an ordinance requiring all electric wires to be placed in conduits within three years.

CHESTER, PA.—Bids will be received until August 6 by Jas. B. Bagshaw, chairman of the Light Committee, for lighting the streets with electricity for a period of 1, 2, 3 or 5 years. Bids will also be received on gas.

PITTSTON, PA.—The City Council has awarded the contract for street lighting to the Citizens' Illuminating Company for $60 per arc lamp per year, and $15.50 per incandescent lamp. The company made a reduction on the arc lamps from $75.

SCRANTON, PA.—The Lackawanna Power Company has filed a certificate in the office of Recorder of Deeds, changing its name to the Lackawanna & Wyoming Valley Power Company. This is one of the new corporations in the city and is preparing to enlarge the scope of its operations.

WILKESBARRE, PA.—A mortgage for $2,000,000 in favor of the Wyoming Valley Trust Company has been filed in the office of the City Recorder by the Wyoming Valley Gas & Electric Company. The proceeds will be used to liquidate a mortgage of $1,111,000 now held by the Anthracite Bank, of this city, and for general improvements. The com-

pany has recently come into control of the lighting plants at Plymouth, Kingston, Nanticoke, Hazleton and several smaller towns throughout the State. It intends to make a number of important improvements during the next few months and extend its system in several towns.

MEDIA, PA.—The Philadelphia Suburban Electric Company has purchased the plant of the Citizens' Electric Light, Heat & Power Company, of Clifton, which was owned and operated by the United Power & Transportation in connection with the Delaware County Street Railway Company. The acquirement of this plant gives the Philadelphia Suburban Electric Company the entire control of all the electric lighting between Media and Philadelphia, and Chester and Philadelphia. The company will build a large station near the center of its territory, from which electricity will be supplied for light and power in the borough of Swarthmore, Morton, Rutledge, Clifton Heights, Aldan, Lansdowne, East Lansdowne, Teadon, Fernwood, Darby, Colwyn, Sharon Hill, Collingdale, Norwood, Prospect Park, Ridley Park, and the township of Ridley, Darby and Upper Darby. It is also understood that the company will apply for a franchise in Chester.

PAWTUCKET, R. I.—It is stated that the D. Goff & Sons Company will erect a large electric power plant for the purpose of supplying electricity for lighting its mills.

CHESTER, S. C.—It is announced that the Southern Power Company, of Charlotte, N. C., will extend its transmission lines from Great Falls to this place. It is understood that the cotton mills will use 1,700 hp, and that the city will take 200 hp for the lighting plant. The company will supply electricity for $20 per hp for twelve hours and $36 for 24 hours.

CHATTANOOGA, TENN.—It is reported that the Great Falls Power Company, which is to develop the water power of the Caney Fork River, has commenced work on the power plant near McMinnville. The power plant when completed will have a capacity of 50,000 hp. C. H. Fisk is one of the promoters.

NASHVILLE, TENN.—At a meeting of the stockholders of the Nashville Railroad & Light Company held recently, the issuance of $15,000,000 5 per cent bonds was authorized. Of this amount $7,500,000 will be marketed at once, $6,000,000 of the proceeds to be used in retiring old securities and $1,500,000 for improvements and extensions of the plant.

MEMPHIS, TENN.—Application for a franchise in this county has been made for the Lakeview Traction Company, of which Thomas Taggart, of Indianapolis, Ind., is president. The request was made for the privilege of locating and maintaining for a period of thirty-five years single and double tracks, poles and other equipment necessary in the proposed electric line from here to Clarksdale, Miss.

MINERAL WELLS, TEX.—The Howard-Burke Engineering Company has secured the contract for the engineering work for a ten-mile electric railway in this town. An electric light and ice plant will be operated in connection with the street railway power plant.

RUTLAND, VT.—The General Electric Company has sold its electric lighting and power plant in this city to the Rutland Railway, Light & Power Company. The transfer gives the new owners entire control of the lighting and power privileges of this city, both gas and electric. The president is G. Tracy Rogers, of Binghamton, N. Y., and Leo H. Wise, of New York, N. Y., is vice-president.

ALEXANDRIA, VA.—The City Council has accepted the bid of Edward E. Mandeville, of Philadelphia, Pa., for the purchase of the electric light plant and franchise for a term of 30 years. Mr. Mandeville offered $5,000 for the franchise alone, or $8,500 for both plant and franchise. He agrees to furnish arc lamps to the city for $75 per annum each, provided that not less than 85 are used, $16.50 for 25-cp incandescent lamps and $19.50 for 32-cp lamps for municipal purposes, and to furnish electricity for private consumption at 12 cents per kw-hour for the first hour and 7 cents for each additional hour, with a reduction of 50 per cent on incandescent lamps used by the city, except in the court house, the Mayor's office and the engine houses, which are to be lighted free.

ABERDEEN, WASH.—The City Council has granted a franchise to E. C. Finch for the establishment of an independent telephone system.

TEKOA, WASH.—Arrangements are being made by the Washington Water Company for the construction of its transformer station, which will furnish electricity for the Mahoney Light & Power Company in this place.

NORTH YAKIMA, WASH.—Only preliminary work has been done on the water and light plants as yet. An election is to be held Aug. 28 for the purpose of condemning and purchasing the system now in use. A. A. Nicol is city engineer.

VANCOUVER BARRACKS, WASH.—Bids will be received until Aug. 11 by Lieut. Bates Tucker, Quartermaster, U. S. A., for installing an electric motor, etc., at Vancouver Barracks. Bidders must state the time when they propose to do the work.

PALOUSE, WASH.—Plans and specifications have been received by D. G. Klinefelter for the new sub-station which is to be erected in this place by the Washington Power Company. Electricity will be furnished from the company's power plant at Post Falls.

SPOKANE, WASH.—The Pend d'Oreille Development Company is preparing to construct a plant at Big Falls, a mile and a half below Metaline on the Pend d'Oreille River. The company contemplates the construction of a plant at a cost of $750,000 to supply electricity for the operation of all mines and electric railroads in that vicinity; also to transmit power to Spokane if necessary. The incorporators are: D. T. Ham, W. S. Yearsley and E. A. Torrence, all of Spokane, Wash.

SEATTLE, WASH.—The City Council of West Seattle has set the price of $30,000 on its street railway and light plant and the Seattle Electric Company has signified its acceptance of the terms, the sale being provisional with the approval of the taxpayers of that city, who will vote on the issue. The fund realized will be devoted to the establishment of municipal water, lighting and sewer systems. The railway and lighting plant was installed over two years ago, the public voting a bond issue of $18,000 to cover the cost. The road has barely maintained itself, even with careful supervision by the municipal authorities.

IRON RIVER, WIS.—The power house of the Iron River Water, Light & Power Company was destroyed by fire on July 18.

MERRILL, WIS.—Work has commenced on the development of the water power for electrical purposes at Grandfather Falls by the Grandfather Falls Power & Logging Company.

KILBOURN, WIS.—The Southern Missouri Power Company will spend about $90,000 in constructing its dam, power plant and transmission line at Kilbourn. Most of the work will be let under private contract. Daniel A. Mead is chief engineer.

KENOSHA, WIS.—The Milwaukee Engineering Company has submitted estimates for the cost of a municipal electric lighting plant to the Council. According to the estimates the city can erect a thoroughly equipped power house for $17,280. The total cost of operation is estimated at $12,110 per year, making the cost of 300 lights, but $40.37 per lamp per year.

NEW WESTMINSTER, B. C.—The British Columbia Electric Street Railroad Company is having surveys made for a line to run from here to Chilliwac. Address R. H. Sperling, general manager, Vancouver, B. C.

VANCOUVER, B. C.—Hermon & Barwell, of Vancouver, Engineers and Surveyors, write that the East Kootenay Power & Light Company is being formed to construct a power plant on St. Marys River, to cost about $300,000.

BRATTLEFORD, CAN.—The question of constructing an electric light plant has been laid aside for the present. R. C. Laurie is secretary and treasurer.

PRINCE ALBERT, CAN.—Three different companies have applied to the City Council for a franchise to build and operate an electric street railway in Prince Albert. One is the W. S. Weeks Company, of Edmonton and Prince Albert; the Prince Albert Land & Investment Company; and James McKay, K. C., for Makenzie & Mann, of the Canadian Northern Railway.

PRINCE ALBERT, CAN.—It is proposed to make improvements to the water works and electric light plant at a cost of about $35,000, and bids for the construction will soon be asked. It is proposed to remove the electric light plant to the new water power station and to combine the operation of the two plants. Willis Chipman, 103 Bay Street, Toronto, Ont., is the engineer in charge.

WINNIPEG, MAN.—The Council has decided to build an electric railway to the site of the proposed $3,500,000 civic power plant for the purpose of hauling supplies. H. N. Ruttan is city engineer.

FREDERICTON, N. B.—The New Brunswick Independence Telephone Company has decided to spend $100,000 in improving its system.

LEAMINGTON, ONT.—The Town Council has granted a franchise to the Windsor, Essex & Lake Shore Radial Railway to operate an electric railway in the town.

LONDON, ONT.—The bill to incorporate the Erie, London & Tilsonburg Electric Railway has been passed and permission given for the company to increase its bonding power from $25,000 to $30,000 per mile.

New Incorporations.

LOS ANGELES, CAL.—The United Electric Corporation has been incorporated with a capital stock of $75,000. The directors are Frank C. Vaughn, D. Arbogast and M. Clayton Jewell.

SAN JOSE, CAL.—The Santa Clara Interurban Railway Company has been incorporated, with a capital stock of $5,000,000, by J. C. Campbell, J. F. Parkinson, F. B. Dorman, W. H. Metson and E. M. Rea.

SAN FRANCISCO, CAL.—The California Midland Railway Company has been incorporated with a capital stock of $3,000,000. The directors are John Martin, Eugene J. de Sabla, Leo H. Susman, Lawrence W. Pryor, Walter J. McLean.

LOS ANGELES, CAL.—The Union Home Telephone & Telegraph Company is the name of the concern incorporated with a capital stock of $10,000,000 and $10,000,000 bonds, and reported last week as the "Home Telephone and Telegraph Company."

WOODSTOCK, ILL.—The Woodstock Heating & Lighting Company has been incorporated with a capital of $35,000. The company has been granted a franchise to furnish electric lighting in the city. D. L. Joslyn, of Woodstock, is one of the incorporators.

EBERLEE, ILL.—Articles of incorporation have been filed with the Secretary of State for the Effingham & Olney Interurban Railroad with a capital stock of $2,500. The company proposes to construct an interurban line from Effingham to Olney. The incorporators and directors are Dr. R. S. Wishard, Daisy Wishard, G. M. Merry, Henry Richars, of Eberlee, and Theron Gould, of Bible Grove, Ill.

HOLLAND, IND.—Articles of incorporation have been filed by the Holland Telephone Company with a capital stock of $1,800 by Christie Rettger and others.

WEST BUXTON ME.—The Buxton & Hollis Power Company has been incorporated for the purpose of manufacturing and supplying electricity for light, heat and power purposes in the towns of Buxton, Hollis, Limington and Standish. Frank H. Hargraves is president and A. W. Flint is treasurer, both of West Buxton.

CUMBERLAND, MD.—The Allegany Light & Power Company has been incorporated by Andrew N. Walker, Andrew P. Maloney, of Philadelphia; Clement Deneen, Charles Belnap and E. R. Bender, of Cumberland, who, with Michael Reinhart, of Cumberland, compose the board of directors for the first year.

KALAMAZOO, MICH.—The Kalamazoo, Gull Lake & Northern Railway Company has been chartered with a capital stock of $200,000.

JOPLIN, MO.—Articles of incorporation have been filed for the Missouri & Southern Railway Company by R. C. Rawlins and L. Rosenthal, of Chanute, Kan.

ROOSEVELT, MO.—The Kiowa County Rural Telephone Company has been incorporated with a capital stock of $10,000 by R. L. Shoup and others.

WARRENSBURG, MO.—Articles of incorporation have been filed with the Secretary of State by the Warrensburg Home Telephone Company by Charles A. Shepard, J. P. Ozias, Harry T. Clark and W. L. Hickman The capital stock is $20,000.

WARRENSBURG, MO.—The Johnson County Home Telephone Company has filed articles of incorporation with the Secretary of State with a capital stock of $150,000. The incorporators are Charles A. Shepard, J. P. Ozias, Harry T. Clark, W. L. Hickman and others.

NORTH LOUP, NEB.—Articles of incorporation have been filed for the Loup Valley Independent Telephone Company by C. E. White and others. The capital stock is $20,000.

NEWARK, N. J.—Articles of incorporation have been filed with the Secretary of State with a capital stock of $100,000 by the Newark Block Lighting Company by James M. Seymour, Jr., David Seymour and Thomas Thompson.

FRENCHTOWN, N. J.—Articles of incorporation have been filed for the Stover Telephone Company, with a capital stock of $10,000. The incorporators are John J. Stover, Carrie C. Stover, Matilda C. Stover, Samuel Eddy and Josiah C. Butler.

CAMDEN, N. J.—Articles of incorporation have been filed by the Philadelphia Electric Equipment Company, with a capital stock of $25,000. The company proposes to manufacture electricity and gas for light, heat and power. The incorporators are J. A. MacPeak, W. F. Eidell and F. R. Hansell, of Camden.

ELLENVILLE, N. Y.—The Ulster Lake Company, of Ellenville, has been incorporated with a capital of $2,000. Dwight Divine, of Ellenville, is one of the incorporators.

BERKSHIRE, N. Y.—Articles of incorporation have been filed for the Berkshire Home Telephone Company with a capital stock of $5,000, by C. D. Phillips, E. L. Freeland and E. F. Lynch, of Berkshire.

NEW YORK, N. Y.—The Manhattan Light & Equipment Company has filed articles of incorporation with a capital stock of $500,000. The directors are H. M. Slauson, G. M. A. Fecke and H. E. Crandall, of New York, N. Y.

NEW YORK, N. Y.—The Rochester-Elmira Traction Company has been chartered with a capital stock of $4,000,000 to operate an electric road from Rochester to Elmira, a distance of 120 miles. The directors are Max H. Schultze, C. O. Geer, Frederick Eckstein, Samuel M. Levy and Tracy S. Breckinham, of New York, N. Y.

ROCKY MOUNT, N. C.—The Rocky Mount & Wilson Railway Company has been chartered with a capital stock of $300,000, to build steam and electric roads, cotton mills, etc. B. H. Bunn, of Rocky Mount, is interested.

Company Elections.

LEWISTON, ME.—At the annual meeting of the Little Androscoggin Water Power Company the following-named officers were elected: W. W. Bolster, president; E. W. Gross, treasurer; directors for the ensuing year: W. W. Bolster, E. W. Gross, H. A. Duncan, of Bath, H. C. Day, John A. Morrill and A. M. Peables.

PITTSFIELD, MASS.—At the annual meeting of the Pittsfield Electric Company held recently the present board of officers, of which Alexander Kennedy is president, was reelected.

FITCHBURG, MASS.—At the annual meeting of the Fitchburg Gas & Electric Light Company held July 25 the following-named officers and directors were elected: Herbert I. Wallace, president; Henry F. Coggshall, treasurer and general manager; directors: Charles T. Crocker, Herbert I. Wallace, Charles E. Ware, Francis B. Shepley, George E. Clifford, George R. Wallace and Henry T. Page.

GARDNER, MASS.—At the annual meeting of the Gardner Electric Light Company held recently the following-named officers were elected: Arthur P. Derby, president; Thatcher B. Dunn, vice-president; Francis S. Whittemore, secretary and treasurer. The board of directors include the officers and Charles W. Conant, Charles F. Richardson, Charles O. Bent, Mrs. Martha Heywood, William D. Smith and Mrs. Helen R. Greenwood.

NASHUA, N. H.—At the annual meeting of the Nashua Light, Heat & Power Company held recently the following board of directors was elected for the ensuing year: Fred W. Estabrook, Frank E. Anderson, James H. Tolles, George E. Anderson and Elbert Wheeler. The company will soon install a 750-hp Curtis turbo-generator set. The new unit is similar to the two units already installed, and is expected to be ready for operation by Nov. 1.

LYONS, N. Y.—At the annual meeting of the Wayne County Electric Light Company held recently the following-named officers were elected: Dwight Chamberlain, president; Charles A. Lux, vice-president; Benton S. Rude, secretary; William H. Akenhead, treasurer; Robb W. Kepple, superintendent.

New Industrial Companies.

LEOMINSTER ELECTRIC COMPANY, of Leominster, Mass., will hereafter be conducted by Thomas A. Mullowney, under the same firm name. The co-partnership heretofore existing between Thomas A. Mullowney and George E. Adams has been dissolved.

THE ELECTRIC PARK COMPANY, of Shawnee, O. T., has been incorporated with $250,000 capital stock. The incorporators are: Alfred Hare and T. D. Smith, of Tecumseh; K. T. Douglass, of Shawnee; Arthur P. Cutter, of Chicago; S. S. Baldwin, of Wichita, Kan.

THE STOLZ ELECTROPHONE COMPANY, of Augusta, Me., has been organized for the purpose of manufacturing and selling electrical devices and instruments, with a capital stock of $1,000,000. The officers are: A. M. Macomber, of Augusta, president; E. J. Pike, of Augusta, treasurer.

THE UNDERCURRENT TRACTION COMPANY, of Lockport, N. Y., has filed articles of incorporation with a capital stock of $100,000. The company propose to manufacture electric motors. The directors are J. W. O'Brien, Lockport, N. Y.; F. J. Brown and F. H. Findlay, of Niagara Falls, N. Y.

THE ELECTRIC HEATING & MANUFACTURING COMPANY, of Los Angeles, Cal., has been formed for the purpose of manufacturing cooking and heating utensils and also to install plants for large consumers of electricity. The company will manufacture under patents granted to George I. Leonard, of Pasadena, Cal.

THE AMERICAN DIMMER COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State with a capital stock of $35,000. The company propose to manufacture dimming apparatus for electrical installations. The directors are H. M. Jones, W. T. Rowland and E. L. Barney, of New York, N. Y.

AUTO-ADVERTISING MACHINE COMPANY, of Portland, Me., has been organized for the purpose of manufacturing and dealing in all kinds of electrical and mechanical advertising machines and novelties, with a capital stock of $1,000,000. Millard W. Baldwin, of Portland, is president and Clarence E. Eaton is treasurer.

Legal.

CURIOUS INQUIRY SUIT.—Two $5,000 suits have been started against Brockton, Mass., and the local Edison company by a woman whose allegation is that she was walking on the sidewalk and was confused by a dense cloud of steam, which emanated from the works of the Edison Electric Illuminating Co. She claims that in consequence of this she fell from the walk into the street, receiving injuries to both knees, spraining a wrist, and suffering a further injury for which she has been treated at the hospital, being operated on a few days ago. To make sure as to the responsibility this double suit has been brought.

TAXING STOCK.—Judge Dobler has handed down a decision in favor of the Baltimore Consolidated Gas, Electric Light and Power Company in the case of this company vs. the State of Maryland, in which the State demanded $25,000 for the refusal of the company to pay a tax bonus of one-eighth of one per cent. on the entire amount of capital stock authorized in the charter of the company. The company had already paid the tax on $13,300,088 of stock issued, but declined payment of the entire amount, which was slightly in excess of $21,000,000. Attorney General Bryan entered an appeal in this case, which went over to the fall term of the Court of Appeals.

MISSISSIPPI TELEPHONE SERVICE.—One of the most important orders ever promulgated by the Mississippi Railroad Commission is that requiring telephone companies to give free service all over any county where it has an exchange. This means that the subscriber has a right to telephone from any and all other towns in the county free of charge, whereas heretofore they have been forced to pay extra for every message to neighboring towns. The rates for such county connections are made somewhat greater than the local rates, but not so much, being regulated by the number of telephones in the county town. The Cumberland Company, which has a large business in Mississippi, has made a vigorous protest against this order, but the commission has reiterated its determination as expressed at the first of July meeting, and has fixed the rates to be charged.

POLES IN WASHINGTON STATE.—According to recent legal opinion, county commissioners can not require telephone companies in the State of Washington to obtain franchises to place poles in the public roads, but poles placed in the roads can be removed if they are found to be a nuisance, according to an opinion written by John D. Atkinson, attorney general, in answer to questions asked by W. W. Sparks, prosecuting attorney of Clarke County. Mr. Atkinson says it is a debatable question whether the owner of adjacent land could recover damages from a telephone company because the poles place an additional burden, but weight of the decisions is that he could. The prosecuting attorney of Clarke County was asked by the county commissioners to proceed against the Pacific States Telephone Company and remove its poles from the roads. The county commissioners notified the company that it would have to obtain a franchise. The telephone company answered that it had a right to use the roads for poles under an act of Congress giving all telephone and telegraph companies the right to use all post roads.

LITIGATION ON POLE AND FIELD WINDING.—We are in receipt of the subjoined communication from the Century Electric Company, of St. Louis, dated July 28: "In the legal paragraph in your paper issued the 24th inst., 1906, on page 155, there appears an article under the subject of divided pole and field winding, pertaining to the Emerson Electric Mfg. Company vs. Century Electric Company, litigation. This article is somewhat misleading if read by our customers, as these are the facts: Just before the Emerson Electric Company brought to our attention the fact that they considered we were infringing their patent, we had developed a new style of field winding and immediately commenced to use it. The Emerson Company sued us and we made answer to the suit, but refused to go to the expense of taking any testimony as we were not interested in breaking down this patent, and therefore the decision was rendered as stated in your paper. You might, therefore, state that this decision was rendered on account of our not contesting the suit, not having any interest in the same on account of our having developed a field winding that suited our conditions much better and that enabled us to accomplish the same results with considerable saving in material; and therefore the court has not passed on the validity of this patent."

SHARING OCCUPANCY OF POLES.—The Supreme Court of Alabama has affirmed a decree dissolving a preliminary injunction in the suit of the Montgomery Light & Water Power Company versus the Citizens' Light, Heat & Power Company of the same city. The conclusions are as follows: (1) A bill by one electric company against another having a franchise in the same city to enjoin the use by defendant of one of complainant's poles averred as ground for relief that complainant already had strung on the pole all the wires it would bear with safety to its service and security to the people of the city, but that, notwithstanding this fact and the fact that the ordinance of the city council expressly forbade defendant from interfering with the poles and wires of complainant, nevertheless respondent "is attempting to string and is stringing" its wires on the pole, and unless interfered with it would so string its wires, which would result in irreparable damage to complainant and make the pole absolutely dangerous to the lives of the people of the city who were walking the street thereof, and in addition thereto would make it impossible for complainant to attend to securing its own wires on the pole, endangering the lives of its employes, who are compelled to frequently climb the pole to repair complainant's wire, and prevent it from successfully furnishing current to the people of the city for lights. Neither the size of the pole, its capacity, the number of wires thereon, the proximity of the wires one to another, nor their location on the pole was averred. Held, that the averments of the bill were mere conclusions. (2) A bill by an electric company to enjoin another company from using one of complainant's poles considered in connection with the denials and averments of the answer, and held, that a preliminary injunction would not be retained till final hearing on the theory that complainant's property was sought to be taken without just compensation. (3) Where an electric company accepts a franchise under an agreement that its poles may be used by other companies for compensation to be agreed on between them, and in case of disagreement the amount to be decided by the city electrician, it is bound to either agree on the compensation or accept the arbitrament of the city electrician, unless shown to be arbitrary or the result of corruption.

DOCTRINE OF COMPARATIVE NEGLIGENCE.—The Supreme Court of Missouri has sustained a decision against the Kansas City Electric Light Company in a fatal accident case. The points of the decision are summarized as follows: (1) The doctrine of comparative negligence does not obtain in Missouri. (2) Defendant electric company having knowledge that an electric light wire was grounded directed its servant, while the current was off, to locate and remedy the defect. The lineman only tested two miles of the circuit, which was 20 miles long, and, though he failed to discover the trouble, reported the line O. K. On the afternoon of the same day, decedent's son, knowing that the wire had become uninsulated, "grounded" the same by attaching a copper wire thereto and turning the wire around a tree, thus making two "grounds" or a dangerous short circuit. The wire came in contact with a cable tied to the tree and used as a swing, and decedent, without knowing the danger, was killed the same evening by coming in contact with the cable. Held, that defendant was guilty of negligence concurrent with that of decedent's son, in turning electricity into the wire without knowing that the same had been grounded, which was the proximate cause of decedent's death, rendering defendant liable therefor. (3) Where, in an action for death caused by a grounded electric light current, it was admitted that the current was not dangerous unless two "grounds" existed, and there was evidence that an abrasion of the insulation from the wire from which the electricity escaped existed for at least a month before the date of the accident, an instruction requiring the jury to find whether or not defendant had exercised reasonable care and prudence in ascertaining and remedying such condition, if it existed, was not objectionable as assuming that two "grounds" existed. (4) Where, in an action for death caused by an escaping electric current, an instruction required the jury to find that the current was transmitted "under the circumstances aforesaid as claimed by plaintiff to have existed," such instruction was based on the prior predicates stated therein, and was not objectionable as permitting the jury to find defendant liable if they found that the current was transmitted under the circumstances claimed by plaintiff, without specifying such circumstances. (5) In an action for death, an instruction specifying all the facts which the jury were required to find in order to make defendant liable, and then charging that if the jury found that the diversion of the electric current in question was the proximate cause of deceased's death, and that such death was due to a want of ordinary care and prudence on the part of defendant and its employes under all the circumstances found by the jury to exist, etc., was not objectionable because it left it to the jury to determine the proximate cause of the death. (6) Where the court admitted certain evidence, but afterwards excluded it as inadmissible, error, if any, in admitting it, was cured. (7) Where, in an action for death by an escaping electric current, it appeared that defendant was negligent in failing to ascertain whether the line was "grounded" before it turned a current of electricity into a trunk line from which it was distributed into the various lamp route lines including the line from which the current escaped, defendant was not prejudiced by the admission of evidence that if the line of wires had been provided with loops so that when trouble, or a "grounding" of the current, was found, that portion of the system might be disconnected from the balance, the accident might not have occurred.

Personal.

MR. E. N. CHILSON has been appointed purchasing agent for J. G. White & Company. Mr. E. V. Peters will continue to act as assistant purchasing agent for the corporation.

MR. J. P. BOYLAN, for some time superintendent of service for the Cuyahoga Telephone Company, of Cleveland, Ohio, has resigned to take up similar work for the Louisville Telephone Company, of Louisville, Ky.

PROF. W. D. PENCE, dean of the School of Engineering at Purdue University, has resigned and removed to Madison, Wis., where he has accepted the position as dean of the School of Engineering at the University of Wisconsin.

MR. J. P. MITCHELL has resigned his position as general manager of the Gallup Light & Power Company, of Gallup, New Mexico, to accept a position as chief electrician for the North American Lead Company, of Fredericktown, Md. This company will install a large electric plant on its mining property.

MR. HENRY M. STEELE, until recently chief engineer of the Central of Georgia Railway, has become chief civil engineer for J. G. White & Co., the engineering and contracting firm of New York. Mr. Steele is a member of the American Society of Civil Engineers and of several other engineering and scientific societies.

MR. C. J. ROSS has resigned as general manager of the Steubenville Traction & Light Company, of Steubenville, Ohio, to become general manager of the Utah Light & Power Company, of Salt Lake City, Utah. A few nights ago his former employes at Steubenville greeted him with a surprise party and presented him with a magnificent silver loving cup as a token of their esteem.

MR. P. M. FERRES, of Montevideo, Uruguay, has been visiting this country inspecting electrical apparatus and plants. The government of his country is making arrangements to establish a large plant at Montevideo, and has sent him here as its representative. He arrived in Washington recently and at once began to make arrangements to thoroughly investigate the systems of the United States.

MR. M. A. SAMMETT, of Montreal, Canada, visited the Locke insulator works recently, in connection with tests of insulators for the new high voltage transmission line of the Montreal Light, Heat & Power Co. Prior to this he made a series of tests of the complete electrical equipment of the Kaministiquia Power Company's plant at Fort William, Ontario. The entire electrical equipment is of General Electric manufacture, but on Mr. R. S. Kelsch's specifications.

MR. P. K. HIGGINS.—Mr. P. K. Higgins, formerly superintendent of construction for the Pioneer Telephone Company in Oklahoma and Indian Territory, who went east some weeks ago to reorganize the maintenance forces of the Wisconsin Telephone Company, has returned to Oklahoma City to accept a position as general superintendent of the Pioneer Company in the two territories. Mr. Higgins is well and favorably known throughout the telephone field.

MR. B. A. WESCHE has joined the forces of the Barriett Electric Manufacturing Company, of Cincinnati, Ohio, as electrical engineer, and will have charge of the design of a new line of machines. He is a pupil of Prof. Arnold, and has had considerable experience in electrical work with the Schuckert Company of Germany, also with the General Electric, Westinghouse and Bullock interests in this country. His specialty is dynamo and motor design and construction.

DR. S. S. WHEELER, accompanied by Mrs. Wheeler, arrived on the "Celtic" last week from England, after participating actively as president of the American Institute of Electrical Engineers in the recent exercises there, and sharing in the lavish hospitality of the Institution of Electrical

Engineers. Dr. Wheeler is deeply interested in automobiling and took occasion while on the other side to look into all the recent developments of that art. He finds a large amount of work awaiting him as chairman of the building committee of the Automobile Club of America, whose new house in this city now nears completion.

MR. T. A. EDISON is to start on a 2,500-mile automobile trip about Aug. 1. Accompanying him will be his wife, his daghter, Miss Madeline Edison, and his son, Charles. Three automobiles will carry the party. One will be loaded with cooking utensils, camping equipments and provisions. The Edisons will tour through northern New York and New England, and then up through Canada, where Mr. Edison will continue his researches into the cobalt deposits of the country. He thinks Canada will be found particularly rich in this element. Mr. Edison made recently a similar trip through North Carolina.

MR. F. A. PICKERNELL, one of the chief engineers of the American Telephone & Telegraph Company, was in San Francisco at the time of the earthquake, and has returned there to assist in the reconstruction of the Bell system. He says: "We have determined to rebuild on the same elaborate scale, but the public must have a little patience, as the switchboards and appliances required had to be specially manufactured, and as fast as they arrive from the factories we are installing them. At the present time we have 127 carloads of telephone supplies en route to San Francisco, scattered between here and the Atlantic Coast and valued at fully $600,000, of which $320,000 are for the latest pattern switchboards." At the present time 15,000 of the terminal 52,000 subscribers are being furnished with service and additional telephones are being installed at the rate of nearly 200 a day. The new system will cost $5,000,000.

MR. W. F. HESSEL, of Chicago, has just assumed the position of general sales manager of the Stuart-Howland Company, of Boston, Mass This addition to the rapidly increasing organization of the above company speaks well for its enterprise, as Mr. Hessel has been associated with some of the largest companies of the country and has earned a wide experience and a broad acquaintance with those interested in the electrical field. During the past 18 years he has closely followed the rapid development of the electric industries, and this has enabled him to cover nearly all of its various branches. His early experience in the practical operation of central stations has proven particularly useful as applied to the advancement of the modern electric supply business with which he has been identified for the past ten years. During the last four years Mr. Hessel has been identified with the electrical industries of the Middle West as sales manager of the Western Electric Company, manager of the Standard Electric Company of Cincinnati (the Ohio branch of the Western Electric Company) and Western sales manager of Pass & Seymour, Inc. Prior to that time he was associated with the Eastern interests and has many Eastern friends who will be glad to learn that he has returned to take a place among them again.

Obituary.

MR. S. ASHTON, a young electrical engineer in the employ of the Birmingham, Ala., Railway, Light & Power Company, was killed in the power plant at Birmingham while making some transformer connections. In some unknown manner he came in contact with a high-voltage circuit, and was killed by the shock as well as badly burned. He was a brother of Mr. J. J. Ashton, purchasing agent of the Sloss-Sheffield Steel & Iron Company.

MR. S. WEIL.—On Saturday morning, July 28, Mr. Samuel Weil, superintendent of the Electrical Lead Reduction Company, Niagara Falls, received a fatal shock of electricity at the switchboard in the plant. Just what Mr. Weil was doing at the time is not known, as he was alone in the room. He was found within a very few minutes after he had received the shock. He was 32 years old, and lived at Niagara Falls. The funeral was held on Monday last.

MR. H. P. BRUCE, lately connected with Rockwell & Bruce, of 26 Cortlandt Street, New York City, died suddenly on July 26, leaving a wife and child. He entered the electrical field in the early days of the Thomson-Houston Company, and remained active in that line of work ever since, having had charge of some of the largest enterprises. He was at one time associate engineer of the Pittsburgh Railways, and was also general manager of the Demerara Electric Company of British Guiana. He had a wide circle of acquaintances in the electrical engineering field.

MR. G. J. TIBBITTS.—The death is announced at Canastota, N. Y., after an illness of some months due to stomach trouble, of Mr. George J. Tibbitts, 71 years old. He began in the blacksmith's trade, but took up mechanics, and became superintendent of the Canastota Electric Light Company. The plant was disposed of to the Madison County Gas & Electric Company, but he continued in the old capacity under the new regime for some time. After retiring from the central station field he was elected town tax collector. He was a prominent mason.

MR. CHARLES ADDISON BRAGG, district office manager of the Westinghouse Electric & Mfg. Company, Philadelphia, Pa., died at that place on Sunday, July 29, after an illness of over two months' duration. Mr. Bragg was one of the pioneers in the electrical business, having been associated with the old United States Electric Lighting Company as early as 1882. His connection with the Westinghouse Electric & Mfg. Company began in the year 1889, when he was made the manager of the Philadelphia office, which position he filled successfully up to the time of his death. Mr. Bragg possessed a most genial disposition, which endeared him to all with whom he came in contact. He was born and reared in Franklin County, Mo. Following his early education, he attended Yale college, from which he was graduated. He was 56 years old. Mr. Bragg is survived by his wife and one daughter. He will be greatly missed by his associates, and particularly at the conventions of the various electrical bodies, so long rendered brighter by his presence. He rarely if ever missed a meeting of the American Street Railway Association or the National Electric Light Association, and for over 12 years he had been an associate member of the American Institute of Electrical Engineers.

Trade Publications.

ENCLOSED FUSES AND THEIR FITTINGS.—The Chicago Fuse, Wire & Mfg. Company, in its Bulletin No. 18, illustrates and lists its various forms of "Union" enclosed fuses, fuse blocks and clips.

ELECTRIC SIGNS.—The Metropolitan Engineering Company, New York, in Bulletin No. 7, Volume 2, illustrates and describes a new raised enameled sectional letter for signs. An account is given of the National Electric Light Association Atlantic City convention, and of the Meriden, Conn., Centennial.

CRESCENT STEAM HEATING SYSTEM.—W. H. Pearce & Company, of 269 Dearborn Street, Chicago, have issued a 32-page catalogue devoted to the Crescent system of steam heating, one feature of which is that it provides a measured service, whereby the amount of heat used from steam or hot water is metered to the customer. The catalogue is profusely illustrated, the engravings showing all of the piping, regulating, metering and other details of the system.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is sending out to the trade a bulletin and circular descriptive of the Stanley-G. I. Type K. arc lamp. The good qualities and merits of this lamp are set forth in an interesting and convincing manner, and the Central Electric Company states that it is carrying a large stock and is in a position to quote attractive prices. Any prospective buyer of arc lamps would do well to write the company for copies of these bulletins and prices.

CARBON BRUSHES.—The Speer Carbon Company, St. Marys, Pa., has issued in handsome form with the title "Carbon Brushes," a practical treatise on the use of carbon brushes for electric motors and generators, written by Mr. J. S. Speer. The book is bound in boards, has a frontispiece portrait of the author and is well printed and illustrated. A series of curve sheets give the result of tests for heating, brush friction, brush voltage drop, contact resistance, wattage loss and co-efficient of friction. Some half-tone engravings illustrate the results of practical tests on various forms of carbon brushes.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is sending out a unique blotter on Okonite printed in two colors, which is causing favorable comment amongst the trade. It reads as follows: "By using this blotter on an order for Okonite you are entitled to a life membership in the society of satisfied users, composed exclusively of those who use and endorse Okonite as the standard for rubber insulation." It is suggested that any one desiring to become a members of the "Society of Satisfied Users" write the Central Electric Company for one of these blotters, when he will at once be absorbed into the organization, and all trouble thereafter be blotted out.

ROTARY METERS.—The Rotary Meter Company, New York, has issued a handsomely executed catalogue illustrating and describing the Thorp and Marsh rotary station meter for the measurement of all artificial and natural gases under either low or high pressure, and the measurement of air supplied to compression machinery, regenerative furnaces, etc. An interesting application of this meter is in connection with gas for cooking, heating or other service separate from lighting. A small meter of the rotary type, which has been named the "discount" meter, is used on the fuel service; the gas consumed on the premises is all measured by the present type of consumer's meter, and on that part of the consumption shown by the small rotary meter an extra discount is given.

News of the Trade.

THE ERNST WIENER COMPANY, of 66-68 Broad Street, New York, manufacturer of industrial track, cars and equipment, has opened a branch office in the Gazette Building, Pittsburg, Pa., in charge of Mr. Paul Miller.

THE JOHNS-PRATT COMPANY, of Hartford, Conn., manufacturer of electric installations and specialties, will erect a four-story brick factory building, 42x94 ft., and also an addition to one of the present factories.

INDUCED DRAFT FOR CENTRAL STATIONS.—Induced draft apparatus for boilers at the following plants is being installed by the B. F. Sturtevant Co., Boston, Mass.; St. Paul Gas Light Co., St. Paul, Minn.; Municipal Electric Plant, Burlington, Vt.; Jerseyville Illuminating Co., Jerseyville, Ill.

MESSRS. CROSBY, CRAFT & CO., Citizens' Building, Cleveland, O., agents for the Fort Wayne Electric Works, report that they have closed a contract with the Stirling Consolidated Boiler Co., Barberton, O., for a 500-kw, 250-volt direct-current engine-type generator. This machine will be used in the extension to the Stirling Company's plant.

THE BROWNING ENGINEERING COMPANY, of Cleveland, Ohio, has leased the plant of the American Foundry & Machine Company, at Ravenna, and will utilize it in the production of castings for the use by the company in the erection of heavy electric and locomotive cranes which are the chief products of the Cleveland plant.

THE GLOBE IRON WORKS, of Dayton, Ohio, has taken a contract to build four large water wheels, together with the necessary power transmission machinery, to be used in developing a 5,000-hp water plant in Snake River, near Silver City, Idaho. The Trade Dollar Consolidated Mining Company, of Silver City, is at the head of the project. The work must be completed within sixty days.

THE WESTERN ELECTRIC COMPANY reports a greatly increasing demand for the "Sunbeam" lamp, due largely to the fact that users are becoming acquainted with its quality. This is the eighteenth consecutive year of the sale of this lamp, and it was one of the first successful lamps produced. The Western Electric Company will answer promptly all inquiries which it receives, and is in position to furnish without delay lamps suitable for all circuits.

CROCKER-WHEELER OFFICES.—As announced in a previous issue, the Crocker-Wheeler Company has now completed arrangements and has opened an office and warehouse at No. 208 First Street, near Howard San Francisco, Cal., with Mr. H. C. Baker as local manager. It has also opened an office at No. 447 Pacific Electric Building, Los Angeles Cal., with Mr. L. Cummins as representative, and is arranging to establish an office in Seattle, Wash., in the near future.

BLAKE INSULATED STAPLES.—In the new Public Service Building at Milwaukee, Wis., put up for the Electric Railway & Light Company, as described recently in these pages, 40,000 Blake insulated staples were used in various sizes for the installation of the telephone lines. The Blake Signal & Manufacturing Company, of 246 Summer Street, Boston, Mass., is in fact kept busy supplying this little article for interior telephone wiring and regards this piece of work as another evidence of the esteem in which the staples are held.

NAVY SAFETY APPLIANCES AT MILAN.—One of the few American exhibits at the Milan Exposition, now open for the season of 1906, is that of the "Long Arm" system of electrically operated bulkhead doors. The exhibit consists of a horizontal sliding door, a vertical sliding door, a hatch gear and the electrical emergency station from which, aboard ship, all important bulkhead doors and the armor hatches are operated. The types of doors and the hatch forming this exhibit are all of the latest model. A great deal of interest has been manifested in Italy in the "Long Arm" system, which is in use on all the new warships of the United States Navy, and it is doubtless somewhat due to the educating influence of this exhibit that a movement has been started in Italy to have incorporated in the Governmental regulations for passenger ships a clause making the installation of power doors obligatory.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Conn.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting, New York City, September or October, 1906.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

AMERICAN RAILWAY, MECHANICAL & ELECTRICAL ASSOCIATION. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 12 West 31st St., New York.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, 60 Wall St., New York. Next convention, Columbus, Ohio, Oct. 15-20, 1906.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting, Hotel Frontenac, St. Lawrence River, Sept. 4, 5 and 6, 1906.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Atlantic City, N. J., June 19, 1907.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto. Ont.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, George B. Tripp, Colorado Springs, Col. Next meeting, Denver, Col., Sept. 18, 19 and 20, 1906.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ELECTRIC CLUB OF CLEVELAND. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

ELECTRIC CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, Wm. R. Stavely, Royal Insurance Building, Montreal, Can. Next annual meeting, January 14, 1907.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York, second Friday of each month.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, New Haven, Conn., Aug. 16-18, 1906.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

IOWA ELECTRICAL ASSOCIATION. Secretary, George S. Carson, Iowa City, Ia.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., Oct., 1906.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James F. Barnett.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, New York City, 1907.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, B. C. Adams, Madison, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, O.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, O.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 136 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D.

Southwestern Electrical and Gas Association. Secretary, E. B. Meginnis, Dallas, Tex.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 24, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

826,529. AUTOMATIC STOP FOR WHIP HOISTS; William D. Baldwin, New York, and John D. Ihlder, Yonkers, N. Y. App. filed Mar. 21, 1904. Has an enlargement on the hoisting rope which contacts with one arm of a bell-crank lever which breaks the pilot circuit. This controls the circuit of an auxiliary magnet which when broken establishes a short circuit through the resistance across the motor armature.

826,534. TELEPHONE SYSTEM; Charles G. Burke and Edward J. Burke, Brooklyn, N. Y. Filed Aug. 6, 1904.

826,542. TELEPHONE TRANSMITTER; Edward E. Clement, Washington, D. C. App. filed May 17, 1904.

826,551. ELECTRIC SIGNAL; Allen B. Dungan, Allentown, Pa. App. filed Oct. 17, 1905. A lever having a cam roll is pivoted above the trolley wire so as to be pressed upward by the passage of a car and complete a signal circuit. The signal circuit includes relays for displaying lamp signals at the entrance to the block section.

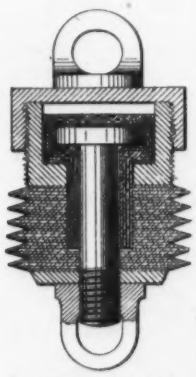
825,565. TROLLEY STAND; Boniface A. Grasberger, Richmond, Va. App. filed Aug. 17, 1905. The trolley pole is normally held in elevated relation by a system of levers so arranged that sudden upward movement of the pole displaces a toggle link and permits the pole to drop.

826,589. ELECTRICAL INSULATOR; Max Meyrowsky, Cologne-Ehrenfeld, Germany. App. filed Jan. 31, 1905. A strain insulator including a plurality of porcelain buttons clamped between a pair of metallic heads by a central bolt. The bolt has an insulating bushing where it passes through the button.

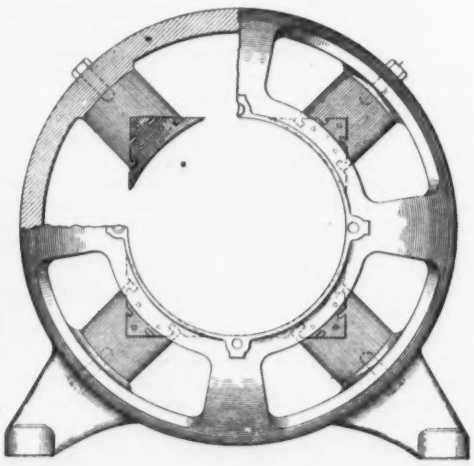
826,615. TELEGRAPHY; Robert J. Sheehy, New York, N. Y. App. filed Oct. 25, 1902. A plurality of alternating current generators are arranged to impress the alternations upon the line so as to actuate the positioning magnet of a printing telegraph instrument. The printing magnet is operated by a separate circuit.

826,627. SLOW RELEASE MAGNET; Louis H. Thullen, Edgewood, Pa. App. filed Dec. 22, 1903. Has means for maintaining a closed circuit around the magnet cores of the device after interruption of the circuit normally energizing the magnet. Said circuit normally derives its energy through the circuit of the magnet.

826,629. CORD SUSPENSION ELECTRIC DENTAL ENGINE; John V. Trenaman, New York, N. Y. App. filed July 21, 1905. A horizontal swinging arm has a pair of pulleys over which a counterweighted cord suspending the dental motor are led.



826,589.—Electrical Insulator.



826,650.—Pole Piece for Electric Machines.

826,650. POLE PIECE FOR ELECTRIC MACHINES; Niels A. Christensen, Milwaukee, Wis. App. filed Apr. 11, 1901. The pole pieces are made of the waste clippings from the armature laminations. They are notched in a special way so as to dovetail upon the cores of the field frame.

826,659. APPARATUS FOR AUTOMATICALLY SIGNALLING THE PRESENCE OF DELETERIOUS GASES IN THE ATMOSPHERE; Henri Hauger, Paris, France. App. filed Apr. 29, 1905. An ordinary physical laboratory balance having a hermetically closed jar in one balance pan. The variations in atmospheric density disturb the balance and give an alarm signal.

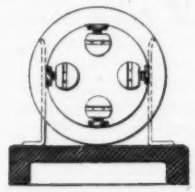
826,668. DYNAMO; Ernest C. Ketchum, Boston, Mass. App. filed July 3, 1905. In order to preclude displacement of the coils of a dynamo driven by a turbine engine, on account of the high speed, the patentee has his coils in the form of disks moving between pole pieces opposite the side faces thereof.

826,680. MULTIPLE SWITCHBOARD CONSTRUCTION; Benjamin F. Merritt, East Orange, N. J. App. filed Aug. 7, 1905. Has a horizontal fireproof partition extending from the rear of the switchboard between the multiple and answering jacks, and other fireproof petitions, all disposed to prevent the spreads of incipient fires.

826,687. WIRE CONNECTOR; Charles L. Pierce, Jr., Chicago, Ill. App. filed Feb. 23, 1904. A metallic block is moved to receive the bent-over ends of the wires to be connected and has a soft metal filling to hold the wires in place.

826,742. PROCESS OF REDUCING METALLIC COMPOUNDS AND PRODUCING CARBIDS; Edgar F. Price, Niagara Falls, N. Y. App. filed Oct. 13, 1903.

826,743. PROCESS OF REDUCING COMPOUNDS AND PRODUCING CARBIDS; Edgar F. Price, Niagara Falls, N. Y. App. filed Oct. 13, 1903.



826,974.—Electric Cut-Out.

826,744. APPARATUS FOR REDUCING METALLIC COMPOUNDS AND PRODUCING CARBIDS; Edgar F. Price, Niagara Falls, N. Y. App. filed Apr. 4, 1904.

826,745. APPARATUS FOR REDUCING COMPOUNDS AND PRODUCING CARBIDS; Edgar F. Price, Niagara Falls, N. Y. App. filed Apr. 4, 1904.

826,752. SIGNALING SYSTEM FOR ELEVATORS; James B. Smalley, Chicago, Ill., and Charles A. Reiners, New York, N. Y. App. filed May 24, 1905. Has a plurality of contact strips and a carrier moving synchronously with the car and having various brushes which contact with said strips.

826,782. TROLLEY; John Brundl, Pittsburg, Pa. App. filed Dec. 11, 1905. The harp has places thereon with projecting cheeks which may be positioned to enter the guides upon the hangers at a switch or turnout so as to prevent displacement of the wheel.

826,799. TROLLEY POLE CONTROLLER; Andrew L. Prentiss, Buffalo, N. Y. App. filed May 10, 1905. A pneumatic cylinder is arranged to be actuated by a sudden movement of the pole so as to lower the same.

826,845. SAFETY DEVICE FOR OVERHEAD ELECTRIC CONDUCTORS; Emile Giraud, Paris, France. App. filed Apr. 10, 1905. The conductor is supported in such a way that breakage of any section tilts certain switch devices at the insulating supports which ground the conductor so as to prevent damage.

826,888. FUSE BLOCK; Joseph Sachs, Hartford, Conn. App. filed June 24, 1902. A switch in which all of the parts are inclosed in a box or casing and in which the switch elements are separated by opening the box cover. The contacts are made by a metallic plunger in an oil bath.

826,910. THERMOSTATIC MAGNET PROTECTOR; John Thulin, Chicago, Ill. App. filed Dec. 12, 1904. Details of construction of a thermostatic coil having a U-shaped strip which supports a spring contact. When the coil becomes heated, a drop of solder melts and allows the spring to open the circuit.

826,916. INSULATOR; Samuel Bartley and William O. Bartley, Calhoun, Ill. App. filed Jan. 2, 1904. A two part box is recessed to receive an insulating block and has a special form of clasp enabling the conductor to be tightly inclosed regardless of slightly varying sizes thereof.

826,938. TELEPHONE ATTACHMENT; Frank F. Howe, Cleveland, O. App. filed Jan. 23, 1906.

826,962. ELECTRIC FURNACE; Benvenuto Platschick, Paris, France. App. filed Nov. 27, 1905.

826,974. ELECTRIC CUT OUT; Herbert E. Trumbo, San Francisco, Cal. App. filed Nov. 20, 1905. A number of fuses are placed around a cylindrical holder which may be located to position a new fuse when any one of the said fuses are destroyed.

826,999. ELECTRICALLY OPERATED BLOCK SIGNAL FOR RAILROADS; Lester Dickey, Perry, Iowa. App. filed Dec. 6, 1905. Details of a semaphore operating mechanism including a motor and a gear train which is connected to move the danger or caution signal as desired. The selection is made by a form of magnetic clutch.

827,054. RAILWAY SIGNALING SYSTEM; Charles P. Breese, Norfolk, Va. App. filed Aug. 11, 1902. Provides means for giving signals either at or near a crossing or to some other distant point, of an approaching car. Has a special trolley and relays connected to be actuated whenever a car passes the corresponding block section.

12,510. ELECTRIC CONTROLLING DEVICE FOR CARS; James H. K. McCollum, Toronto, Can. App. filed June 18, 1906. The combination with the brake lever and hold-fast device and a motor for controlling such hold-fast device, of an auxiliary controller provided with a finger and contact plate for throwing the current in and out of the motor.